THE GLASS INDUSTRY

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CANADA STARTS AN OPTICAL GLASS INDUSTRY

Research Enterprises, Ltd., costing nearly $7,000,000, is formally dedicated July 8 by Minister of Munitions and Supply C. D. Howe. Plant is Canada's newest war industry and is a complete optical glass factory from the making of the pots to the finished optical pieces. Now is making six kinds of glass.

On Tuesday, July 8, the Honorable C. D. Howe, Minister of Munitions and Supply formally opened to the service of the Dominion, the first optical glass establishment to be built in Canada—Research Enterprises, Ltd. The plant is completely government owned, cost nearly seven million dollars to build, and not only manufactures the glass itself, but also does all of the cutting, grinding, polishing and other operations incident to producing the complete optical instrument.

Research Enterprises, Ltd., holds a peculiar appeal to the glass industry of the United States, because American manufacturers of optical glass played an important role in establishing the enterprise. Our own A. N. Finn of the National Bureau of Standards gave valuable assistance to the Canadian management; in fact, the melting methods now in use are a modification of those employed by the Bureau of Standards and by Chance Bros. Pittsburgh Plate Glass Co. supplied some pots and helped otherwise. Toledo Engineering Co. engineered the furnaces and pot arches. Bausch & Lomb, American Optical Co., and Spencer Lens Co. made other contributions; but a wholesome awe of the Canadian censor who must pass upon this description before it can be published, makes it unwise to reveal details.

The manufacture of optical glass as a Canadian enterprise was first conceived in the summer of 1940 by General A. G. W. McNaughton, formerly head of the National Research Council in Ottawa and now Commander-in-Chief of the Canadian forces in England. Being at war, Canada needed all types of armament as well as equipment for that armament, to send to England and the other war zones. These included fire control instruments, range finders, gun sights, tank periscopes, etc. A site was picked near Toronto, and Colonel W. E. Phillips, president of the Phillips Glass Co., Oshawa, was nominated *deus ex machina*.

Col. W. E. Phillips, president of Research Enterprises Limited. Note R.E.L.'s motto.

H. C. Bates, director of the Optical Glass Division, was formerly with Corning Glass Works. He is one of the men who went to England to study optical glass methods.

Slip casting a pot. The average of 5 pots a week are made in one section of the factory.

Colonel Philips is a go-getter according to the best American tradition. Given a plot of ground and the go-ahead, it took him just eight months to dig the foundations, build the factory, staff it, and complete the first melt of optical glass. There is a motto in Colonel Phillips' room: "The difficult we do immediately—the impossible takes a little longer." Here is told the whole story of this remarkable human dynamo.

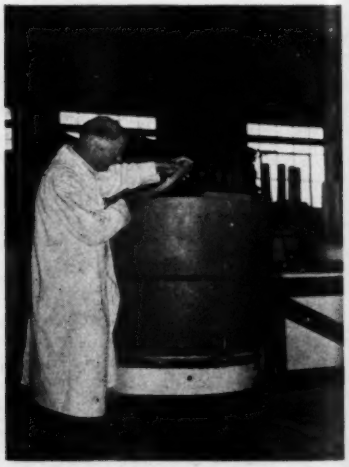
Associated with Colonel Phillips are several experienced glass men. While Colonel Phillips was digging the factory foundations, three went to England and spent some time at Chance Bros. studying methods of optical glass making and finishing, purchasing equipment, and recruiting experienced hands to man the key positions in the plant. They also visited the United States, visiting the American plants mentioned. As a result of all this careful preparation and ground work, Canada has a plant second to none anywhere in the matter of equipment.

The factory itself occupies about 3½ acres; but only a portion of this is devoted to glass. Research Enterprises, Ltd., houses a number of defense projects, of which glass is only one. For example, the new radio locators, about which so much has appeared in print of late, will be made in this plant and they are just getting into production. It is estimated that by late September, all of the specialized production of the factory will be in full swing.

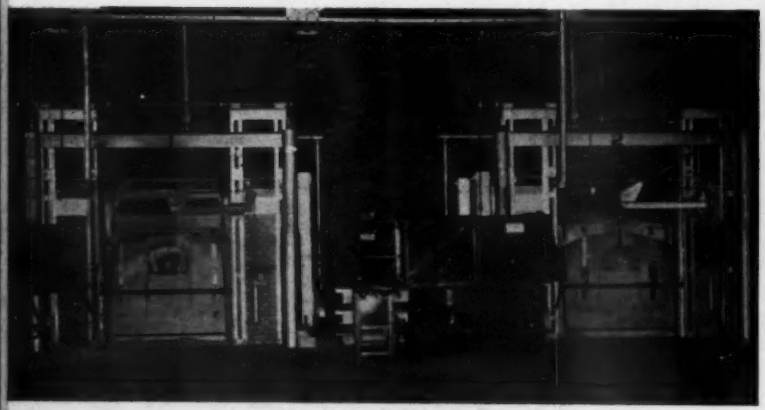
Turning now to the facilities available for manufacturing optical glass, we come first to the melting pots. In design, they are patterned after those made by the Bureau of Standards; but they are larger and depending

Removing the outer section of the mold from one of the slip cast pots.

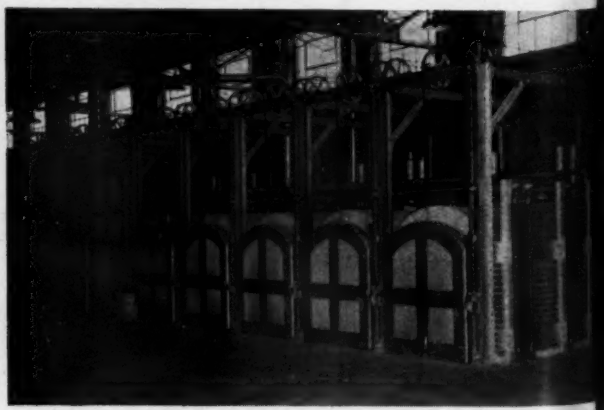
Marking the top of the pot.



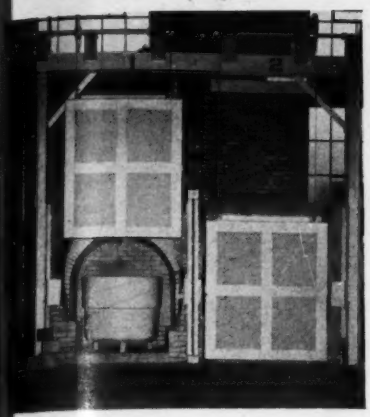
Trimming the pot for height.



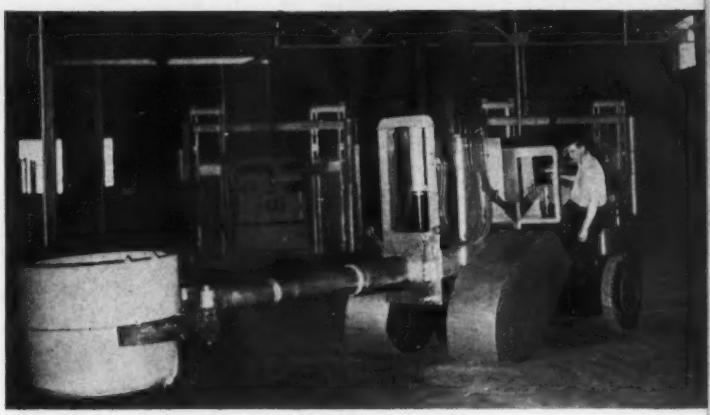
A view of the two city gas fired regenerative furnaces.



The bank of eight pot arches.



The cooling arches which also can be used for firing the pots.



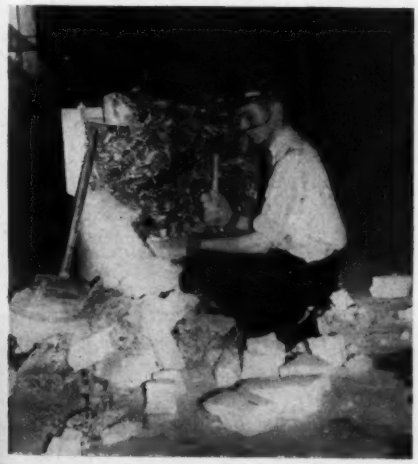
Moving a pot with "Winnie." Note "Winnie's" nameplate on the side of the pot carriage. The carriage is hydraulically operated and was built by the Howell Industrial Truck Co., of Cleveland, Ohio.

upon the type of glass to be melted, range in capacity from 1800 to 2400 pounds. They are made by the slip-cast method, in which clay is poured into a plaster mold. Slip casting, incidentally, is an American development and is many times more rapid than the old hand method. After the pot is completed, it is allowed to age awhile in storage. When required for use, it is pre-heated in one of the pot-arches, placed in one of the two melting furnaces and then filled with batch.

Since the purity of the batch is one of the prime essentials in the manufacture of high quality optical glass, this factory goes to unusual lengths to attain near perfection. Proper equipment will solve many of the difficulties ordinarily encountered. Because the tonnage in an optical glass factory is not large, an elaborate mechanized system is uneconomic and weighing and mixing is done by hand. Scoops and pans used in handling the batch materials are of stainless steel and are cleaned each time.

Raw materials are screened into the batch mixing box, mixed, and then screened again a number of times in order to break up even the smallest lumps and to insure thorough mixing. It is next shoveled into a wooden batch cart and wheeled to a small bin located at the side of the furnace mouth. Cullet is stored in a huge wooden locker, which contains compartments to keep the different type of glass separated. All sand, before use, is run through a Dings magnetic separator.

Glass is melted in two regenerative-type furnaces, fired with city gas. The original furnace design made by the Bureau of Standards was somewhat modified by the Research Enterprises, Ltd., which awarded the contract for detailing and erecting both furnaces and pot arches to the Toledo Engineering Company and to the Francis Hankin Co., Ltd.



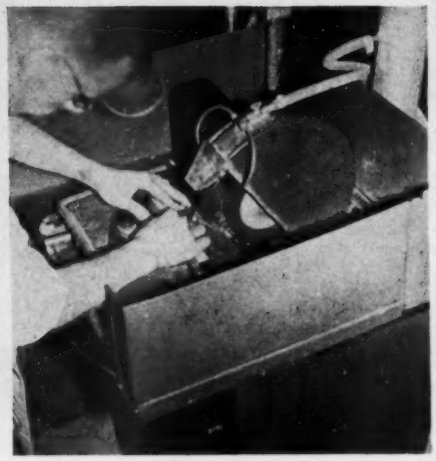
L. D. Finlayson, technical adviser to Mr. Bates, is breaking up a pot of optical glass.

Grinding the edges of the rough slabs or plates on a Sommer and Maca grinding table.

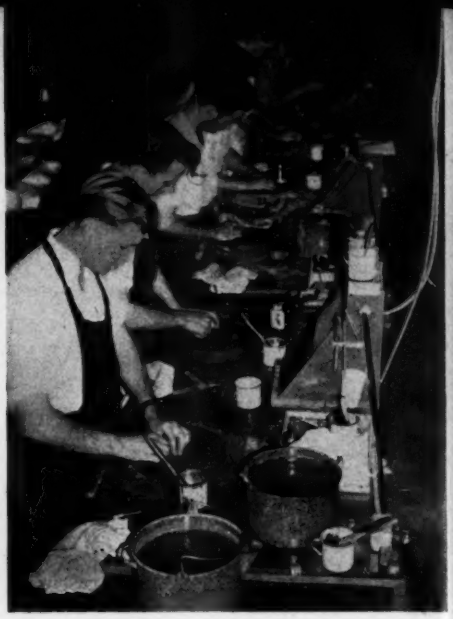
The slabs, with the opposite ends ground and polished, are immersed in a liquid and tested.

The slabs are further tested.

Finished storage room for the optical glass. The pieces of glass are drawn out as needed and finished into prisms or lenses.



One of the slabs of glass being cut into a rough prism by means of a cut-off saw.



A series of grinding plates.

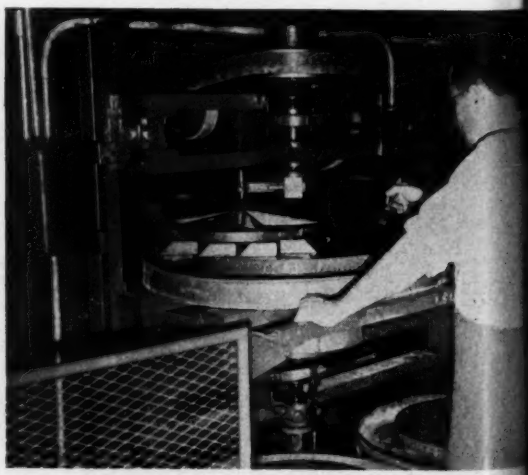
Empty pots are placed in the melting furnace by a hydraulic pot carriage. An American viewing this device would find it strongly reminiscent of the type used in the States and manufactured by Howell Industrial Truck Co. of Cleveland, only in Canada, it is called "Winnie," and carries a metal plate on its side on which is depicted a portrait of Winston Churchill. "Winnie" is like his British namesake—an indefatigable worker that is indispensable to the effective operation of the plant.

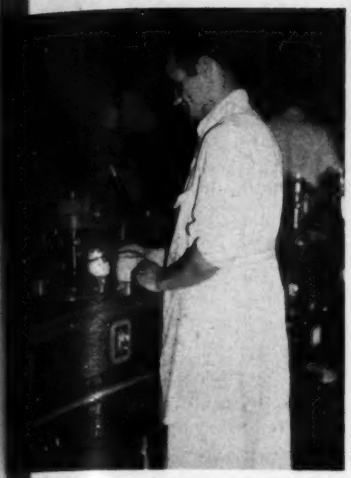
Once the pot is placed in the furnace, the temperature is raised and raw materials gradually loaded into the receptacle. Following a preliminary fusion, the molten glass is stirred. The melting requires from 24 to 30 hours to complete, after which the pot is removed and the glass "frozen" into position by sudden chilling of the pot with streams of cold water. The pot is then placed in a cooling arch and the temperature reduced at a pre-determined rate over a period of approximately 96 hours. Then the pot is removed from the arch and broken up by means of a sledge hammer.

The chunks of glass thus obtained are examined and selected for size and quality and "trimmed" on 12″ grinders. They are then weighed to mold sizes, reheated and molded into slabs or plates. The slabs are rough annealed, ground and polished on opposite edges and inspected for striae and other defects. The good pieces are cut out and put into finished storage. From finished storage the pieces are drawn out as needed for lenses or prisms. The pieces are trimmed and ground for weight, remolded, rough annealed and inspected for mold and glass defects, fine annealed on a carefully predetermined schedule, reinspected and sent back to finished stores. Orders are filled from finished stores for the other departments. In many cases it is possible to reduce the amount of grind required on lenses and prisms if the glass is first pressed to the approximate shape of the finished piece.

At the present time six glasses are being melted and include the following: boro-silicate crown, hard crown, medium crown, light flint, dense flint and extra dense flint. More glasses can be melted if needed. Fifteen

(Left) Mounted polished prisms being inspected. (Center) Rough grinding a lens in a revolving cup. (Right) Polishing tank periscope prisms.





ishing lenses on a lens-polishing chine.

Inspection of finished lenses.

Assembly of optical components and metal parts. A completed tank periscope is at the worker's elbow.

types are used in the various instruments. Restrictions to 6 glasses is desirable. The refractive indices range from 1.510 to 1.653 and the dispersion factors from 64.4 to 33.6.

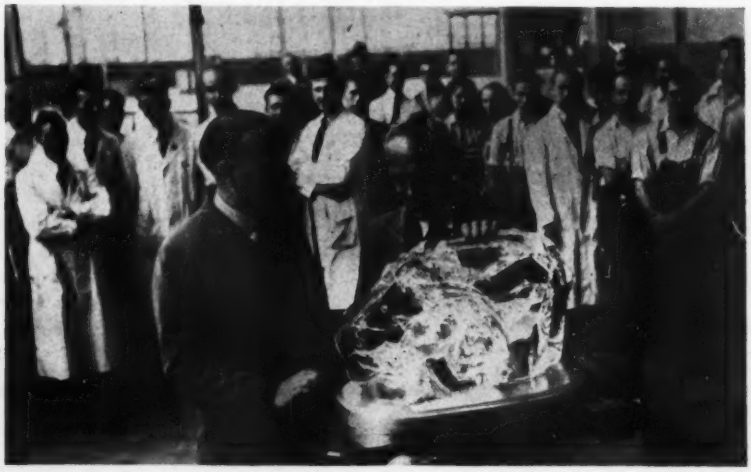
All control instruments for furnaces, arches and annealing are by Leeds & Northrup. These had to be specially built to operate on the 25 cycle current that is used in the factory and furnished by the Ontario Hydro Electric Commission.

The grinding of the lenses and prisms is accomplished in a separate department. Slabs of optical glass are cut to shape for prisms on one of several cut-off machines. The pieces are mounted in pitch on a plate, ground one side at a time, and then polished. The prisms are then subjected to various inspections and go to the assembly stock room. Lenses are polished in a room that is lighted by means of mercury lamps. The lens blanks are mounted on pitch in cups or plates by girls. After the lens have reached the desired dimensions and polish, they are inspected. If they pass the inspection, they are suitably protected and sent to storage.

The assembly of the various instruments using optical parts takes place in a room regulated for constant humidity and constant temperature. The room is equipped with optical benches, bench lathes, test equipment and a drafting room. During the assembly, the instruments are tested under a vacuum and when completely assembled are placed in a steam bath, checked at −40° F. and given other various physical tests before finally turned over to the Services for use. Thus from the reception and test of the original raw material to the final shipment, every precaution is taken to insure perfect product.

On Tuesday, July 8, Research Enterprises Limited was formally dedicated. The Honorable C. D. Howe, Minister of Munitions and Supply spoke to the organization in the Glass House and expressed his admiration to the group. He was presented by Col. Phillips with a piece of the first melt of optical glass to be made in Canada. Later in the afternoon, Mr. Howe spoke to all the assembled workers of R.E.L. and predicted that by the end of September Canada will be producing every type of equipment that is planned to be made in Canada. The plant was dedicated by the Rev. H. J. Cody, president of Toronto University.

Col. W. E. Phillips and the Hon. C. D. Howe examining a piece of optical glass at the dedication of the new factory.



Col. E. W. Phillips and Mr. Howe standing behind a 158 pound sample taken from the first melt. This piece was presented to Mr. Howe at the dedication ceremony, July 8th.

GLASSMEN START WORK ON DEFENSE ORDERS

A meeting of Indiana and Ohio manufacturers was held on June 26 at the Roberts Hotel, Muncie, Ind., for the purpose of organizing their facilities in behalf of the defense program. Those attending were W. F. Huntley and J. W. Eldred, Federal Glass Co; A. C. Crimmel and H. H. Crimmel, Sneath Glass Co; J, M. Foster, Foster-Forbes Glass Co; L. Wolfe and H. Shaw, Canton Glass Co; C. D. Rau and Otto Samuelson, Fairmount Glass Co; J. C. Schwab, Anchor Hocking Glass Corp; William Ball and Ray Warren, Ball Brothers Co; V. Ritter, Armstrong Cork Co; T. C. Werbe and Mr. Heckler, Lynch Corporation; C. P. Overmeyer and E. E. Sandifar, Overmyer Mold Co; and B. Kelly, Kelly Tool Co; Victor L, Hall, Glass Container Association.

It was explained to the meeting that in line with accepted procedure for handling negotiations with the government it seemed advisable for the several companies to appoint a single member from their number who would receive the specifications. The meeting appointed the Overmyer Mold Co. as the prime contractor. An Estimating and Analyzing Committee was also appointed by the glass companies. This committee will determine the method of production, and the production time per unit as the basis for a price to be formally bid.

The Ohio-Indiana group already is working on the first defense order secured by virtue of this set up, a sub-contract for a large number of parts for 50 shell loading machines being made by the Spayd Ohio Company. Many so-called small companies are in need of defense orders and the defense program needs their facilities; but difficulty is being experienced getting supply and demand together. The procedure which Mr. Overmyer and his group followed will show others a sound method of approaching the problem. We will tell the story just as Mr. Overmyer told it to THE GLASS INDUSTRY.

"I learned from OPM that the Spayd Ohio Company was working on an order for 50 shell loading machines. After a lot of discussion, this concern sent three of its representatives to Winchester, Indiana, to see what the average jobbing machine shop, working with glass factories, looked like. After checking our machines very carefully, they decided our equipment could work in very nicely with their order for 50 shell loading machines.

"A few days later, another group of three representatives came to my office with a lot of blue prints. We went over them minutely and were able to select a good many items which the machine shops of our group could make. It was decided that the Overmyer Mould Company would make two of each of the parts, one to be shipped to the Spayd Ohio Company from which they could assemble one machine immediately, and the other part to be sent to one member of our group as a master part, with blue prints. Before shipping any of our parts, one of their inspectors would come to Winchester and inspect it. The job was taken on an hourly basis, with no price set."

This Muncie organization of glassmen is the fruition of six months of study by the glass container industry. Last winter, and long before the present defense effort got seriously under way, the glass industry began to think of its machine and mold shop facilities in terms of national defense. In those early days, it foresaw the problem that only now has become a nightmare for the big brains in Washington—that while the facilities of its comparatively small factories would avail but little individually, yet if they could be harnessed up and coordinated they immediately grew to be a factor.

Action on this problem was taken by a survey of mold and machine shop facilities, and once it was known how many and what type of machines were available, the question of what could be done with them would be more easily solved. The Association saw the need of the services of a technical man who knew the men of the industry and its equipment. Mr. Overmyer offered his services to coordinate effort on a dollar a year basis. Mr. Ovemyer's proposal to serve came up for consideration at the annual meeting of the Association at Hot Springs, Va., and the G.C.A. directors quickly saw the value of the suggestion and gave him the job of carrying it out.

The survey gave the industry exact data as to the number and types of machines available—shapers, planers, drill presses, lathes, etc. Very few milling machines were found to exist. The survey also yielded data on the number of skilled workers available and also the actual hours per week each of these employees was already working. These labor figures made it plain that no considerable amount of work could be taken on by the existing personnel unless the restrictions were relaxed limiting the hours per week these employees could work.

As a result of this preliminary survey, a definite plan of procedure is beginning to take shape. A few companies have facilities sufficiently large to enable them to take on defense contracts independently. For example, Owens-Illinois Glass Co. is making small tools and gauges for munitions makers and other prime contractors. Armstrong Cork Co. has set up a special Munitions Division, which is heavily engaged. Ball Brothers, Thatcher Manufacturing Co. and Hazel-Atlas Glass Co. also have accepted independent contracts.

Along with these independent contractors, a grouping of smaller units is contemplated. For this plan, the Indiana-Ohio organization, referred to in the opening paragraphs, is being tested out. Incidentally, it appears obvious from the Muncie meeting that Mr. Overmyer's duties are changing rapidly and he will have to devote much time to ferreting out types of machine shop work that can be successfully handled. Illustrative of this is the fact that Colt Patent Fire Arms Co. has shipped to the Greensburg plant of the Overmyer Mold Co. six gunbarrels of 45-inch length for rough turning. At Greensburg it will be determined whether or not the horse power of the average lathe used for turning iron is sufficient to operate the lathes for rough cutting the gunbarrels to be returned to Colt for inspection. The experiment will reveal a close approximation of the cost factors involved.

• The New York office of Friedrich & Dimmock has been closed permanently, owing to the death of Mr. Frank L. Dimmock. All business will be transacted through the home office at Millville, N. J.

SPECTROCHEMICAL ANALYSIS OF GLASS SAND[1]

By MORRIS SLAVIN[2]

For some years the College Park, Maryland, laboratory of the Bureau of Mines' Nonmetals Division has been using spectrographic methods for analyzing silicate minerals incidental to the investigations carried on. Although problems at this station are of a research nature the technique used lends itself just as well to routine work, and for this reason a description of the method may be of interest to those engaged in glass-plant control. The description will be illustrated by the determination of the iron oxide content of glass sands, but as the method is perfectly general it can be applied without significant changes to other material of the glass plant, including the finished product.

As it is quite impossible to treat the various aspects of the subject of spectroscopy within the scope of this paper a rather full bibliography on the more general portion of the field is included so that the subject may be pursued further by those interested.

The concept underlying the procedure is simple. A direct-current arc between graphite electrodes is used. The sample is placed in a core bored in the lower electrode. When the arc is struck by a momentary short circuit the sample fuses to a glassy bead and the constituents commence to vaporize. Boiling proceeds in exactly the same way as such material would boil in any ordinary furnace operating at a temperature sufficiently high for the purpose; that is, the more volatile constituents vaporize first and the more refractory ones last. As the vapors enter the highly heated space between the electrodes dissociation of the molecule into its constituent atoms takes place, and these emit their characteristic arc spectra, which enter the spectrograph and are photographed. The volatilization sequence of the various elements is not under the control of the operator, and the spectral intensity varies continuously from zero to a maximum and down to zero again. While this is taking place the photographic plate collects the energy being emitted, as the photographic emulsion acts as an integrator. Under the circumstances the only way of assuring that the photographed spectrum represents the sample, both as to the elements present and as to their concentration, is to vaporize the sample completely. If, in addition, the weight of the sample introduced into the arc is known, there is a fixed relationship between the composition of the sample and its spectrum. As might be expected, this relationship is linear, that is if, say, 5 micrograms of iron in a glass-sand sample emit 20 units of energy as measured on any arbitrary scale, then 10 micrograms will emit 40 units.

Consider now a certain spectrum line of some particular element. It is clear that its density on the plate can be built up during the exposure in two ways—by increasing the amount of the sample or by increasing the concentration of the element.

With this idea as a basis, a method of analysis can be worked out as follows: The plate is exposed to a series of standard samples, of the same weight but of graded composition, along with the unknown. After the plate is processed the unknown can be interpolated by simple inspection or, more accurately, by densitometric measurement between two of the standards, and the composition of the unknown can thus be arrived at. This is essentially the method used, although the actual procedure is much more simple and rapid.

The principal trouble with this scheme is that it necessitates photographing the spectra of a series of standards each time an analysis is made. This objection can be overcome by comparing both primary standards and unknowns to a single secondary standard, which could be used for all analyses. This arrangement, besides being much more flexible, permits greater reproducibility in a single exposure than several exposures of standard mixtures.

This secondary standard is a carefully controlled iron arc, recently described in the literature (2) and therefore needing no further description here. The comparison is made by photographic photometry, which consists in weakening the stronger of two beams of radiant energy by a known ratio until it equals the weaker beam, the

[1]By permission of the Director, Bureau of Mines, U. S. Department of the Interior.

[2]Assistant metallurgist, Nonmetals Division, Eastern Experiment Station, College Park, Md.

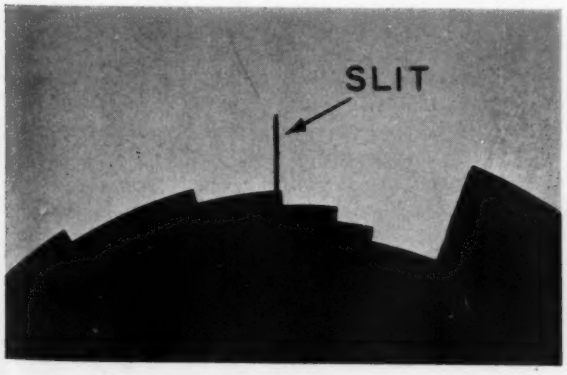


Fig. 1a. Step-sector at rest, showing relation to the slit of the spectrograph.

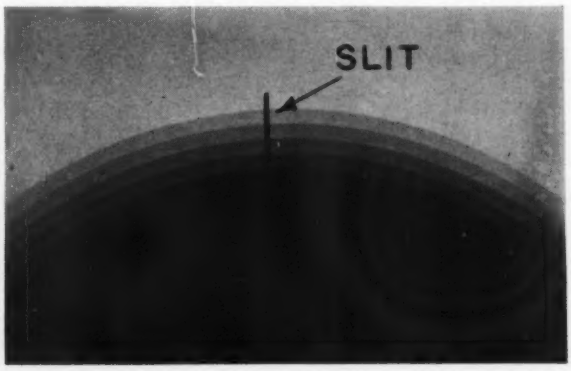


Fig. 1b. Step-sector spinning rapidly, showing the manner in which the light entering the slit is modulated.

Fig. 2. Appearance of a typical quantitative spectrum plate, with the calibrating iron spectrum above and twenty-sample spectra below.

point of equality being taken when the two result in equal photographic density on the plate. The device by which this weakening of the standard is accomplished is a step-sector, which is a metal disk whose periphery is cut in steps, as shown in Fig. 1a, so that its effect is similar to a series of neutral filters of varying opacity, and the fraction of the light transmitted is then equivalent to the angular opening of each step.

In practice the secondary standard is photographed in this manner. A line in this spectrum is chosen, the densities of its steps are measured, and these densities are plotted against the known transmission, resulting in the curve of Fig. 3. The spectra of the samples, either known or unknown, are photographed on the same plate without the step-sector, and the transmission (or energy) values, corresponding to the density of some line of the element being determined, are read from this curve. This gives a numerical value for the line of the element sought, which bears a linear relation to the amount of that element contained in the sample. A typical plate with the secondary standard and a series of sample spectra is shown in Fig. 2.

An example of a standardization and subsequent analysis of several unknown samples will serve to illustrate the method as explained here. Postulate the problem to determine iron oxide in the range 0.1 to 0.01 per cent, using as our known sample Bureau of Standards glass sand No. 81, certified analysis 0.073 per cent Fe_2O_3. For simplicity the known and unknown samples will be placed on the same plate, although ordinarily they are on different plates, the iron-arc secondary standard being the only tie between plates.

All samples are weighed and transferred to the electrode cores. The standard iron-arc exposure is made through a step-sector followed by exposure of the glass sands without the step-sector. After processing of the plate, which now has the appearance of the one shown in Fig. 2, the steps of the iron line 3017 in the stepped spectrum are measured and plotted against the known transmissions of the sector disk. This results in the graph shown in Fig. 3. The density of the iron line 3037, which shows a favorable range of gradations in this range of concentrations, is measured in each of the glasses and spectra. The energies corresponding to these densities are then read from the graph of Fig. 3. The specific emission is then determined for each known by dividing the energy by the weight (a convenient unit to use is the microgram) of iron oxide contained in each sample. These data are collected in table 1a, which covers the known samples for the determination of specific emission, and the operations can be followed easily from these data and the curve as given here.

Once the constant of specific emission has been obtained, it is applied to the data of the unknown samples. These data are collected in table 1b, which represent four samples run in duplicate. The whole process, as one can gather from this description, is closely akin to gravimetric analysis. The sample is weighed in, converted to radiant energy, separated into its constituent parts by the spectrograph, and these parts are "weighed" by measuring the radiant energy each emits.

TABLE 1a

DETERMINATION OF SPECIFIC EMISSION, USING BUREAU OF STANDARDS SAMPLE NO. 81 (GLASS SAND)

Exposure	*Weight, milligrams*	*Density, Fe 3037*	*Energy*	*Weight Fe_2O_3 in sample, micrograms*	*Specific emission*
1	21.5	1.64	19.7	15.7	1.25
2	23.4	1.71	21.5	17.1	1.26
3	27.0	1.74	23.0	19.7	1.17
4	27.8	1.86	27.5	20.3	1.35
5	24.8	1.70	21.3	18.1	1.18
6	29.2	1.83	26.5	21.3	1.25
7	24.9	1.77	23.8	18.2	1.31
8	26.3	1.70	21.3	19.2	1.11
				Average	1.24

The results given in these two tables are typical of a great many we have obtained on a variety of minerals. The average error of a single observation from the mean of a series is about 6 or 7 per cent of the amount present, with occasional errors up to about 15 per cent. Ordinarily samples are run in duplicate, so that the larger deviations can be detected readily and the analysis repeated. For duplicate analyses the error for a determination is reduced to about 5 per cent—that is, to about one part in twenty. This uncertainty is roughly independent of the percentage present, contrary to the experience of chemical procedures, where the error is usually a fixed value. For the latter method, consequently, a very high relative accuracy is expected when the concentration is high, which decreases with decrease of concentration. Speaking very generally, the chemical and spectrographic methods are equal in accuracy at about 1 per cent, with a steadily increasing advantage for the spectrograph as the concentration decreases from this point.

TABLE 1b

ANALYSIS OF UNKNOWN GLASS SANDS

Sample No.	*Weight, milligrams*	*Density, Fe 3037*	*Energy*	*Weight, Fe_2O_3, micrograms*	*Per cent Fe_2O_3*
1a	23.7	1.26	11.0	8.9	0.038
1b	26.1	1.29	11.7	9.4	.036
2a	25.4	1.70	21.5	17.3	.068
2b	24.8	1.71	21.7	17.5	.071
3a	28.2	.93	6.4	5.2	.018
3b	26.2	.86	6.1	4.9	.019
4a	22.8	2.28	65	52.5	.23
4b	24.7	2.37	81	65	.26

Chemical procedures are many and varied, depending on the element being determined and possible interfering substances. Some procedures are rapid and accurate,

others slow and uncertain. Spectrogaphic procedure, on the other hand, is the same for all metallic elements.

The cost of a spectrographic laboratory is high, at least twice the cost of a well-appointed chemical laboratory on a "per-man-working-space" basis. Equipment, which includes a large quartz or grating spectrograph, with the necessary densitometer, direct-current supply, and other accessories, costs at least $5,000. To justify such an installation the work load it is intended to carry must be large and complex in character from the point of view of chemical procedure. For example, in a small laboratory in which the bulk of the work is the determination of surface iron by simple acid solution followed by titration, a spectrograph would be a waste of money. But in a large laboratory, turning out per day a large number of difficult determinations, the installation of a spectrographic laboratory may cause a large saving, equivalent to the total cost in the space of a year or two. This condition is most likely to hold in a large plant whose sources of raw material supply are variable and hence must be carefully and fully controlled.

The advantage of the spectrograph lies in the rapidity with which it can handle samples. One operator, working on a routine basis, can make about 40 exposures a day, which means about 20 samples when run in duplicate. Moreover, all the impurities in a glass sand can be determined simultaneously, with no need of additional exposures, so that the cost on a "per determination" basis is reduced still further. The cost of reagents also enters into this comparison. Because very low concentrations are being dealt with, large head samples must be taken for chemical analysis, and large quantities of first-grade (hence, expensive) reagents must be used. The cost of "reagents" for the spectrochemical method, on the other hand, is trifling.

There are other factors that enter into this balance sheet but that cannot be evaluated so easily. Speed of analysis is one of them. If necessary, a spectrochemical analysis can be turned out in less than 20 minutes. This, in terms of storage bins and freight cars tied up waiting for an analytical report, can amount to large sums.

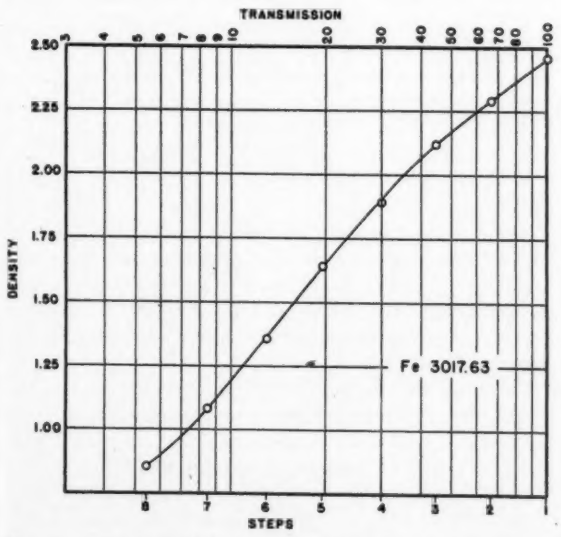


Fig. 3. Characteristic curve of the plate measured for a specific wave length.

Another application of the spectrograph whose worth is difficult to assess is in the field of qualitative analysis, which in an industrial plant is used chiefly for trouble-shooting. For this it is without a peer. The composition of a sample, with rough estimates of the quantitative relations, can be learned in 15 minutes with a sureness approaching certainty, with no preconceived notions as to what to look for—all this on a sample that need be no larger than a single 65-mesh grain.

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CELLULOID COMPANY'S PATENTS UPHELD WHEN USED FOR LAMINATED GLASS

Judge Leslie R. Darr of the Federal Court, Toledo, Ohio, has reversed the ruling of Special Master Conn in the suit brought by the Celluloid Corporation against the Libbey-Owens-Ford Glass Company for infringement of the former company's "Walsh" patent. This patent has to do with the inserting of pliable sheets and chemical compositions between layers of glass, thus preventing them from shattering when struck. Mr. Conn had ruled that in so far as the manufacture of safety glass is concerned, the Walsh patent was not infringed. Judge Darr, however, states that the use to which a patent is put cannot be made the controlling factor superseding the prior art.

INDUSTRIAL SPECIALISTS WANTED

The Civil Service Commission has announced examinations for Industrial specialist positions. Industrial specialists may be called upon to perform any of three types of service: (1) As liaison representative in developing and maintaining working relationships with manufacturers of materials or equipment vital to the defense program; (2) As consultants on industrial materials, methods and processes, or they may examine and evaluate data secured from the reports of industrial concerns; (3) As investigator and analyst in the field of industrial materials, which involves the collection of data on production techniques, uses, consumption and market supplies of particular materials.

Full information and application blanks may be secured at any first or second-class post office or from the Civil Service Commission in Washington. Applications close August 7th. The positions pay from $2600 to $5600 a year.

ANALYSIS OF ACCIDENTS IN THE GLASS INDUSTRY

Rating glass-making fifth best among 30 major industries of this country in the severity of accidents, and ninth best in point of frequency, the annual report of the National Safety Council gives encouragement to all operators of glass factories in their campaign against injuries. The glass industry had half as many and approximately 40 per cent as severe injuries as the general average in other industries. Glassmen achieved a 14 per cent reduction in the frequency rate and a 5 per cent reduction in severity, which is a far better record than the others made.

However, the prevention of accidents is a campaign of ceaseless vigilance, and the wise industrialist spends little time on self congratulation but turns quickly to examine the mistakes that did occur. Consequently, factory superintendents and department foremen charged with these responsibilities will find their greatest interest in that part of the report which analyzes the cause and nature of those accidents. This analysis, incidentally, is not confined to accidents reported in 1940, but covers a seven-year period, during which time 52 plants reported 72 serious accidents.

Agencies of Injury. The following tabulation shows machinery to have been the cause of 40 per cent of the serious accidents. Of the various kinds, presses, grinding wheels, saws, and jointers figured in most accidents.

Agency of Injury	*No. of Injuries*
Total	72
Machinery	28
Elevators and hoisting apparatus	8
Trucks and other vehicles	7
Floors, ladders, and other working surfaces	5
Hand tools	4
All other	20

Types of Accidents: The first item in the following table "Caught in or Between," refers to employees who injured themselves by getting their hands, feet or other parts of their bodies in moving equipment. Accidents of this type occur in closing the doors of a freight car; the hand being placed over the door joint gets caught when the door is closed.

Type of Accident	*No. of Injuries*
Total	72
Caught in or between	31
Falling, sliding, and flying objects	19
Striking against	9
Falling from one level to another	5
All other	8

Mechanical Causes: The table of mechanical causes is one which the factory superintendent should examine with particular care, for these accidents not only are numerous but often lie within his personal province to prevent.

Mechanical Cause	*No. of Injuries*
Total	72
Unsafe methods and procedure, poor housekeeping etc.	25
Improper guarding	24
Worn, broken, poorly designed, or otherwise defective machinery and equipment	9
Lack of or non-use of protective equipment	3
No mechanical cause	11

Personal Causes: Suggestive of the need for the factory management to give instruction in matters that may affect the employees' safety is the table of personal causes. For example, one of the accidents included here was a new worker who sustained a serious eye injury because he was unaware of the danger of handling lime without goggles.

Personal Cause	*No. of Injuries*
Total	72
Unaware of safe practice, and lack of experience and skill	29
Disobedience of instructions and other improper attitudes	17
Physical defects	6
No personal cause	20

Unsafe Acts of Employees: All of the above data is based on an analysis of 72 accidents over a seven-year period. Another analysis, Unsafe Practices of Employees, has been made from a study of 33 accidents occurring during the past four years. These principal unsafe acts are shown in the following table:

1. Using defective machinery, using the wrong tool for the job, and using hands instead of tools. A mechanic, for example, used his hand instead of a brush to sweep some steel shavings from a drill press. He drove a sharp splinter into his hand, infection developed, and the man lost part of the use of the hand.
2. Failure to wear safe clothing and to use protective equipment, such as goggles.
3. Cleaning, repairing, adjusting, or otherwise working on moving machinery.
4. Starting, stopping, or otherwise operating equipment without authority, or without giving or getting the proper signal. Unsafe acts of this type occurred particularly in handling materials with cranes.
5. Gripping insecurely, taking the wrong kind of hold, lifting improperly, and otherwise handling materials unsafely by hand.
6. Injecting, mixing or combining one substance with another so that an explosion or other hazard is created.

Regarding the accident situation by type of product, incandescent lamps and radio tubes made the best showing. Two factories in this group had no-accident: best among large plants was the Westinghouse Lamp Division at Bloomfield, N. J., with a perfect score during 1,016,000 man hours; and best among small plants was the Trenton, N. J., plant of this same company, with 752,000 perfect man hours.

The flat glass industry had the worst accident record, and actually had more numerous and more severe accidents last year than in 1939. Ford City Plant No. 4 of the Pittsburgh Plate Glass Co. had the lowest frequency rate among large plants in this group, and also the lowest for severity.

Other factories on the honor roll for 1940 are the Carr-Lowrey Glass Co. of Baltimore, and Owens-Illinois Glass Company's Factory 17 at Clarion, Pa.

It was stated in the opening paragraphs that the glass industry occupies an enviable position compared with other industries in the matter of its accident record. These excellent results are due largely to the successes achieved since 1939 and particularly in 1940.

THE MELTING AND WORKING OF QUARTZ GLASS

By WALTER HAENLEIN*

The author writes from the glass laboratory of the Osram Company, which is the most important electric lighting concern in Germany. He points out that the recent development of lamps using metallic vapors, and operating at high temperatures and pressures requires a corresponding development of heat-resisting glasses for tubes and bulbs. Eventually, this means quartz glass or fused silica, and other glasses of similarly high softening temperature. The problem is not only to make these glasses in large quantity, but to produce rods and tubes of accurate dimensions at a low price.

Temperatures of 2000° C. and over are necessary for melting quartz glass. A diagram (Fig. 1) showing the viscosity of quartz glass compared with an ordinary commercial glass brings out the fact that fused silica has not yet become as fluid at 2000° C. as the commercial glass is at 1480°. This demonstrates that it is very difficult to melt quartz glass so that it will be really homogeneous and particularly, free from bubbles. When silica, that is, pure sand, is heated to 2000° C. the mass melts, to be sure, but it is by no means fluid enough to permit the bubbles to escape. The result is, therefore, a milky white product filled with bubbles, which goes under the name of "quartzware" (quarzgut). If the usual methods of clearing ordinary glass are applied, that is, elevation of temperature until the necessary fluidity is reached, silica exhibits the unfortunate property, in contrast to normal glass, that it vaporizes very rapidly from the viscous condition.

It is, therefore, practically impossible to melt clear quartz glass from sand in the customary glassmaking procedure. One possibility should be mentioned in this connection, which is the introduction of gas between the sand grains which will diffuse through the quartz glass in later operations, for example, hydrogen.

It becomes necessary to melt clear rock crystal if transparent glass suitable for the mercury vapor lamp is to be produced in quantity. Rock crystal can be obtained quite cheaply, but the heating of this material offers a complication. Quartz inverts at 573° C. with sudden expansion. If rock crystal is heated rapidly, as in the glass furnace, it will shatter into tiny pieces on account of this change. The product will then be filled with seeds. The rock crystal must be very slowly heated up to about 800° C., and then it can be put into the hot furnace.

*Condensed translation by S. R. Scholes from *Glastech. Ber.*, November 1940.

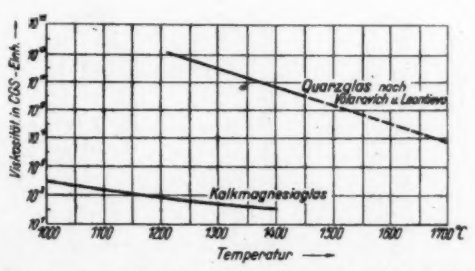


Fig. 1. Comparative viscosities of quartz glass and ordinary glass.

The problem of crucibles for melting silica offers difficulties which have been met in part by the use of zirconia, iridium and carbon; and corundum has also been suggested. Iridium was used in the oldest experiments. For the most part, workers in this field have dispensed with crucibles, in view of the fortunate circumstance that, on account of its great viscosity, the silica will not flow away. The high temperatures required have been obtained by using the oxy-hydrogen burner, the flaming arc, or the resistance furnace.

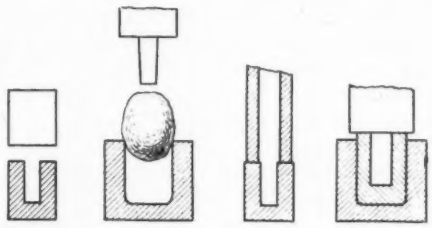


Fig. 2. Heraeus working process.

Brevity requires that we describe only the most important of the attempts to melt quartz glass. The extreme secrecy surrounding this field prevents our knowing how far the experiments applied have had practical application. Moreover, there must have been experiments of certain technical importance about which nothing has been written, and which, on this account, we cannot describe.

Older Methods

The gas-oxygen burner which served for the first melting of quartz glass by Marcet (1813) is still used today in most working processes involving this material.* The Heraeus firm in Germany first melted rock crystal to quartz glass in pure iridium crucibles, which were later replaced by zirconia, and worked the glass in the oxy-hydrogen blast. Fig. 2 shows the process used by Küch (Heraeus) who bored a hole in the melted quartz glass body; or the hole could be formed by pressing with plunger and mold, as shown. The hollow cylinder formed by either method was re-melted and worked in the blast. Zotos avoided the crucible difficulties by using a rotary tube furnace.

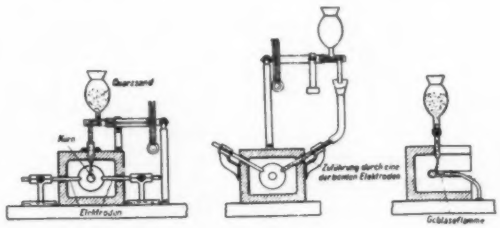


Fig. 3. Arc furnace of Silica Syndicate Ltd., London.

Some mechanization of the melting process was accomplished by Silica Syndicate, Ltd. of London, who arranged the lump of quartz glass between two electrodes and applied rotation and forward and back movement of the body while the melting and stretching took place. This process seems to have been fairly successful in England. (Fig. 3)

An American process used a compound such as silicon chloride, introducing it directly in the flame, where it hydrolyzed, forming silica vapor which condensed directly to the body desired. There is no published evidence as to the success of this process.

The fusion of quartz glass in the arc goes as far back as Moissan and Gautier, about 1880. Askenasy fused a layer of quartz granules under an arc, forming a plate which was later welded together to form the walls of hollow ware. Hutton used a closed arc furnace in which quartz sand was melted around a carbon core. (Fig. 4)

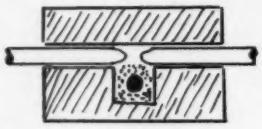


Fig. 4. Hutton's arc furnace.

The Heraeus firm used a rotating hollow form in which the crushed raw material was introduced continuously, or in batches, and after melting was induced to take the form of the mold by the operation of centrifugal force, thus forming tubes and hollow ware. The heat was applied inside the mold by a flaming arc. The "Rotosil" product seems to have been made in this manner.

A number of other attempts have been made to use the arc, but so far as we know, this has never been as important as the other two methods of heating, the gas-oxygen burner and the resistance furnace. The first application of the resistance furnace goes back to Despretz, who observed, in 1849, that a pasty quartzware tube formed around an electrically heated carbon core bedded in quartz sand. E. Thomson (Fig. 5) applied this principle to the process which he developed in 1904. He surrounded a carbon core with sand and led a current through it so that the core became surrounded with a layer of melted quartz sand. Afterward it is possible to withdraw the core. Bent tubes can be formed by using a bent core which is later burned out. In the same patent it is disclosed how sheets can be formed with the help of an arc spread magnetically. The sheet is later curved and cemented into hollow ware. These ideas developed into much that is practical in the production of quartzware.

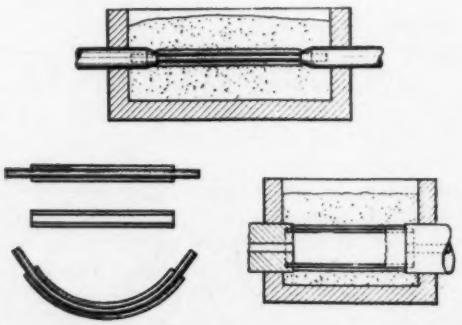


Fig. 5. Thomson's method.

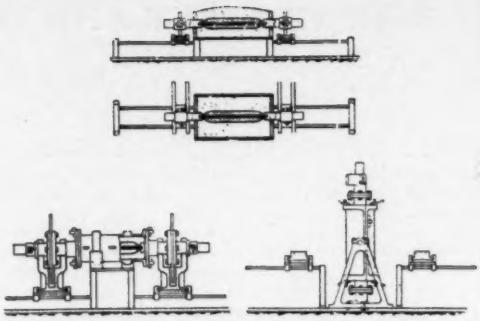


Fig. 6. Furnace of Bottomley and Paget.

Bottomley and Paget (Fig. 6) used a similar process, applying a current of 1000 amp. at 15 V. The furnace rotated slowly. This produced tubes suitable for reworking. They found that the fused silica could be blown or pressed after removal from the furnace, even after it had appeared to become rigid. It is only necessary to apply sufficient mechanical power to overcome the increasing resistance to flow. The viscous mass prepared by the above method was closed at one end with the help of tongs, seized at the other end by forming tongs, and forced into a mold. The tongs carried a blow-head, which supplied compressed air to the interior of the mass and thus shaped it into dishes, flasks, tubes and other hollow forms.

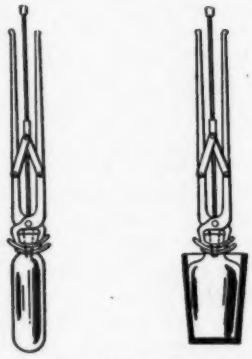


Fig. 7. Forming tongs used by Bottomley and Paget.

Certain other workers succeeded in making articles of larger surface by arranging the carbon resistors side by side so as to form a series of small tubes fused together laterally.

Askenasy explained the release of the quartz tube from the carbon resistor by the formation of carbon monoxide as a result of reaction between the silica and carbon. Figure 8 shows the result of this gas pressure.

The German-English Quartz Melting Company applied the apparatus shown in Fig. 9, in which tubes and rods could be drawn by a continuous process. Voelker showed how a piece of wood could be enclosed in the hot silica tube so that the resulting gas evolution inflated the tube so as to fill a mold. (Fig. 10)

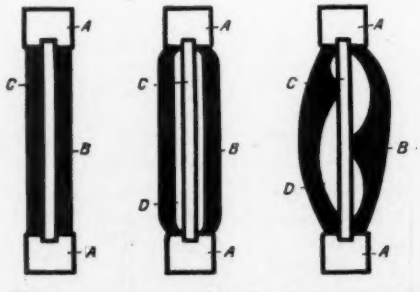


Fig. 8. Melting procedure with electrical resistor. (Thomson).

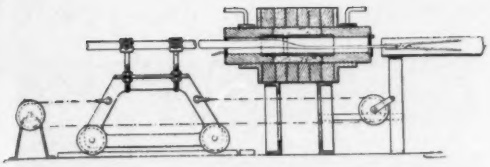
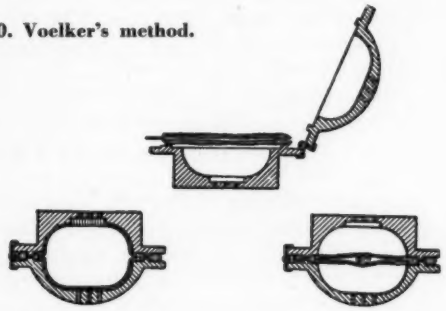


Fig. 9. Process and furnace for shaping fused quartz. Deutsch-Englische Quarzschmelzen G. m. b. H.

The great problem of refining, that is, of freeing the glass from bubbles, persists, also, in the melting by resistance furnaces. Hellberger developed the use of vacuum while the quartz was being melted, following this by a pressure of 20 atmospheres of carbon dioxide, which so reduced the few remaining bubbles that they were practically invisible. The British Thompson-Huston Company also partially solved this problem by melting the quartz in a crucible heated by a combination of induction and resistance, and at the same time rotated rapidly so that the bubbles were brought to the inner surface of the resulting hollow cylinder. When the rotation stopped, the melt settled to a solid cylinder with the bubbles on top and clear fused silica beneath.

Fig. 10. Voelker's method.



When the high-frequency induction furnace is used for the melting process, as in Fig. 11, it has the advantage that the carbon core may be made in the final shape of the desired article.

After a certain technical success in the production of quartz glass, attempts were made to do away with hand operation. One of the apparatus used for continuous drawing of tubes is shown in Fig. 12. The melting crucible and the debiteuse arrangements are made of carbon.

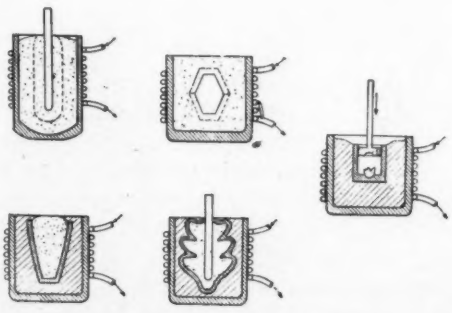


Fig. 11. H-F induction furnace, S. A. Quartz et Silice, Paris.

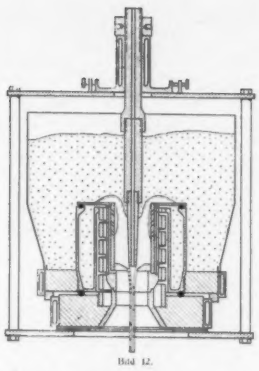


Fig. 12. Device for melting and drawing quartz tube.

The Osram Processes

Since, unfortunately, none of the foregoing methods is suitable for producing fused silica ware in large quantities, the later developments at the Osram plant became of great importance. The furnace is first described. It is essential that a temperature of 2000 to 2200° C. can be maintained continuously. Although this can be done with gas-oxygen mixtures, the cost is too great. Moreover, the close temperature control necessary for mechanical tube drawing cannot be secured with gas. These difficulties are not present in the electrical furnace, but the former furnaces heated by molybdenum or tungsten elements embedded in the insulating wall were not satisfactory because, above 2000°, the insulation becomes conducting. It became necessary to separate the heating element from the insulation, and this was worked out in the Rossignol furnace shown in Fig. 13.

In this furnace, the tungsten resistance wires (1) are fastened to the clamping rings (2 and 3) by screws so that they form the elements of a cylinder. The clamping rings are fastened to two water cooled caps (4 and 5). The upper cap is solidly attached to the water-cooled shell of the furnace (6), while the lower cap carries on its outer circumference a ring (7) filled with oil, in which dips a ring screwed into the jacket of the furnace. In this way expansion is compensated and the interior of the furnace is protected from the atmosphere. The furnace proper is insulated with zirconia (8).

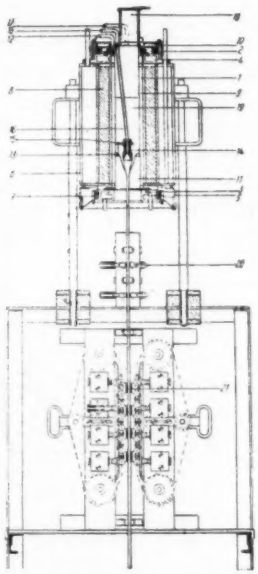


Fig. 13. Sectional drawing, Osram furnace.

The melting crucible was made of sheet molybdenum and tungsten cemented with the help of the flaming arc. These metals are not attacked by the fused silica. This form of crucible is shown in Fig. 14 with the tube-drawing tool or debiteuse projecting from it. The crucible appears at (9) in Fig. 13, and the tube-drawing nozzle in Fig. 15.

In operation, the molten silica issues from the nozzle and is drawn by the mechanical device shown. A neutral gas introduced at (16) keeps the tube hollow and of proper size. More gas is introduced at (17) to protect the crucible. Pre-heated rock crystal is continuously introduced through the charging shaft (18). Beneath the drawing machine, the lengths of tube are successively cut off. For assembled apparatus see Fig. 16.

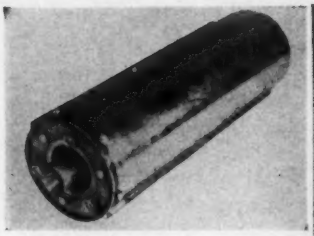


Fig. 14. Melting crucible showing drawing nozzle.

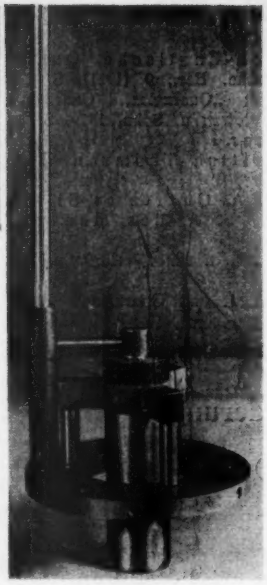


Fig. 15. Drawing nozzle.

The new process provides a completely transparent quartz glass tube (Fig. 17) of standard physical properties. The quantity produced is so great that the operation of the machine becomes economical only when a large production of tubes is necessary, for example, for mercury vapor lamps.

The paper also describes how the apparatus was used for the production and study of certain high-melting glasses, which are not of particular interest.

In the furnace just described, quartz glass tubes can be drawn with a maximum outside diameter of 10 to 15 mm. Other installations are in process of construction in which it is expected that tubes as large as 30 and 40 mm. diameter will be drawn.

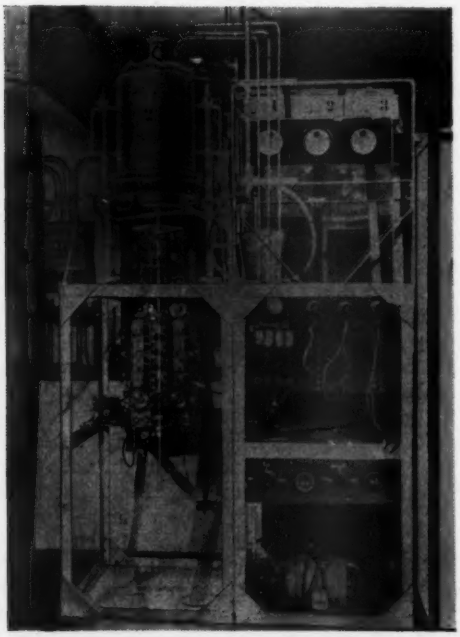
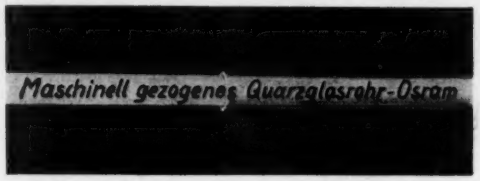


Fig. 16. Osram furnace and drawing machine.

Fig. 17. (Below) Illustrating the transparency of a quartz glass tube.



DR. H. MAURACH HONORED

On the occasion of the 22nd meeting of the Deutsche Glastechnische Gesellschaft at Nurnburg, March 10 and 11, the presiding president of the Society, Dr. Ing. Maurach, was presented with the O. Schott memorial plaque. This honor is conferred only on those persons who have achieved outstanding success in practical or scientific work in the field of glass technology and science. Thus far it has been given to only two other men, the deceased Dr. H. Tammann (1929) and professor Dr. H. Keppler (1933). Dr. Maurach is, therefore, the second living man to receive the plaque.

The O. Schott memorial prize is a beautiful little plaque of rock crystal, 10 centimeters in diameter and engraved in relief with a portrait of O. Schott. The work was executed by W. von Eiff of Stuttgart. The plaque sets vertically in a small decorated gold stand. The recipient of the prize is also given a diploma attesting to this signal honor.

This was a joint meeting of Deutsche Glastechnische Gesellschaft and Heittentechnische Vereinigung deutschen Glasindustrie. Over 300 members were present. Dr. O. Seeling was elected general director of the two organizations and made the plaque presentation to Dr. Maurach. Best wishes were extended to Dr. Maurach for a long continuation of the excellent work he has carried on so long.

Dr. Maurach's many friends in the United States and other countries will be glad to hear of his honor as the recipient of the O. Schott award.

A spokesman for the American Potash & Chemical Corporation stated recently to a representative of THE GLASS INDUSTRY: If and when the Corporation resumes normal operations, and if there is no labor shortage in this plant, and other plants operate as usual, the present borax shortage should soon be a matter of the past. Priorities should be unnecessary. When the strike ends, and pending return to normal operation, the Corporation has stocks of finished borax from which it can draw. Over 10,000 tons of refined borax and a substantial stock of semi-refined borax is on hand and available for shipment immediately.

Besides the United States Conciliation Service, the National Mediation Board was brought in to settle the strike. Both sides were called to Washington from April 29 to May 3 for conferences, but settlement was not accomplished.

• The American Glassware Association in a bulletin to members calls attention to the fact that the American flag may not be used as a decoration on merchandise.

INVENTIONS AND INVENTORS

A Summary of United States Patents of Interest to the Glass Industry Issued During June

Compositions

The now sizable group of Bair-Garbisch patents on the recovery and use of plate glass grinding waste has received two additions in a patent issuing to George Bair and one to Norbert S. Garbisch. The latter patent (2,245,473) relates to the use of such material in glass batch. The distinguishing feature of this patent is that iron is kept from the mixture of sand and glass dust polished from the plate glass surfaces, by avoiding the use of steel polishing runners. These runners are the revolving blocks or discs under which the sand slurry is sluiced and which bear upon the sand. Garbisch suggests the use of many non-metallic materials for these runners, such as glass, porcelain, hard wood, plastics, ets. As mentioned in connection with the reviews of other patents held by Garbisch, the recovered grindings consist of silica and about 20 to 40 per cent of abraded glass. The Bair patent, 2,247,270, proposes to utilize the grinding waste in making shaped articles. In this technically interesting process, the sand and glass grindings are heated above the sintering point (that is to 1600-1800°F.) and while still hot are shaped into useful form by pressing in a mold, and are then annealed and cooled.

In his well known work on electric melting and fining of glass, John Ferguson of Cleveland has found it advisable to so choose his batch constituents as to avoid gas-forming materials which, however, might not be objectionable in ordinary fining operations. In patent 2,247,331 he applies such principles to a boro-silicate glass containing 80 to 87 per cent silica.

Furnaces

Figure 1 shows certain features of an electric glass melting and refining furnace described in patent 2,244,267 by Games Slayter, Flavius W. Atkinson, and Ed. Fletcher, all of Newark, Ohio. The patent was assigned to Owens-Illinois Glass Co. Their object was to provide an electric melter, small and compact and having a high melting rate without excessive current densities and without high heat losses. An important feature consists of arranging at least one of the electrodes (the grill work of Fig. 1) in the path of the moving raw batch, so the batch will wipe the surface of the electrode and automatically cool it. This is said to be so effective in giving the electrode a low operating temperature that the electrode may be chosen from a large class of materials, including all of the common metals and alloys such as iron, brass, copper, steels, as well as the more precious metals.

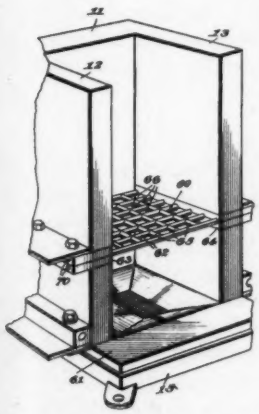


Fig. 1. 2,244,267: Slayter, Atkinson and Fletcher. An electric glass melting furnace in which batch passes through a grilled electrode to cool it.

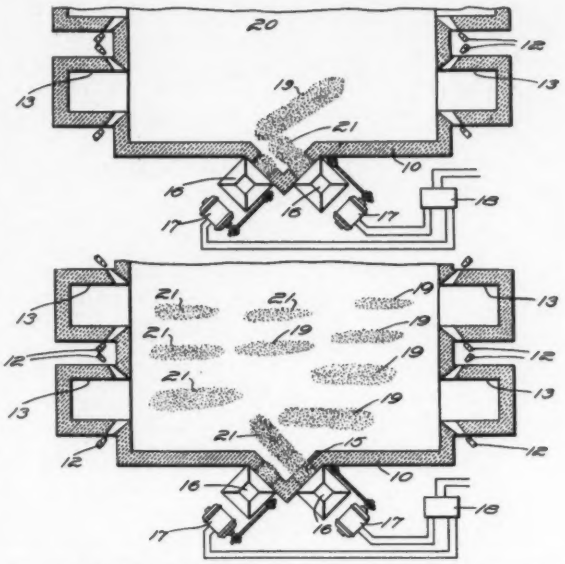


Fig. 2. 2,246,375: Lyle. Two batch feeders operated alternately and at right angles so as to utilize the melting end more fully.

It is reported that high voltages may be used and that the higher the rate of melting used, the lower will be the temperature of the electrodes, and the greater the furnace efficiency. The rate of batch feed is dependent upon the rate of discharge or pull of glass from the furnace.

In addition to the grill electrode, the bottom of the furnace is surfaced with another electrode in the form of a plate through which the refined glass is drawn. The charge feeding element, not shown in Fig. 1, may take any one of the known forms, and may contain additional heating elements.

The grilled and solid electrodes may obtain their energy from a variable transformer. There is least difficulty due to oxidation of the electrodes when high frequencies of the order of several hundred or a thousand cycles are used. The inventors like an arrangement which allows the electrodes to be hooked up either as resistors or as electrodes in series with the intervening glass. With this system, they may first serve as resistors and supply heat for heating the cold glass, within the furnace, at the start of the operation, to a point at which the glass is capable of carrying a current. Then when the glass is molten enough to carry the current, the electrical connections may be changed so that the electrodes are in series with the intervening glass, so that melting is continued by means of heat created within the glass from electrical energy.

Figure 2 shows Aaron K. Lyle's plan for the operation of two batch feeders alternately and at right angles to each other through a single doghouse. This is patent 2,246,375 assigned to Hartford-Empire Co. Lyle points out that normal charging methods form a connected relatively narrow stream of batch on the surface of the glass

bath, extending straight out into the furnace or to one side, depending on the direction taken by the mass at an early stage of its formation. The improved distribution described by Lyle is obtained by forming what he has termed quotas or masses of batch alternately distributed on opposite sides of the furnace. In operation the batch emerging from one batch feeder intersects the tail end of the preceding quota from the other feeder and aligns it in the manner suggested by the upper portion of Fig. 2.

An improved forebay construction for a furnace operated in conjunction with a suction type gathering machine is described in an Owens-Illinois patent, 2,246,364, granted to Clarence C. Kinker, James E. McBurney, and Robt. W. Hopkins of Alton, Ill., and John A. Tassick of New York. Their objectives are the familiar ones of improving the homogeneity of the gathered charge and of seeing that chilled portions of glass have a minimum effect on subsequent gathers. The patent claims describe their forebay construction as providing an incoming channel section extending to the gathering position, a deep return channel for excess glass, and a shallow intermediate zone at the gathering position so the glass will flow rapidly past it.

Feeding, Forming and Shaping

Thomas F. Pearson, Pontefract, England, obtained patent 2,245,813 (assigned to Crown Cork & Seal Co.) for a shearing device for use with devices for charging a forming machine. The novel details of construction are largely directed toward giving greater adjustability to the travel of the individual shear blades and to the shearing unit.

Madison M. Cannon Jr. of West Hartford, Conn. (Hartford-Empire) describes in patent 2,246,461 an hydraulic feeder plunger whose rate of movement can be altered at any point in the course of its travel. The principle is shown broadly by Fig. 3. The plunger 10, controls the feeding of the glass charge by the nature of its stroke toward and away from the outlet. The plunger

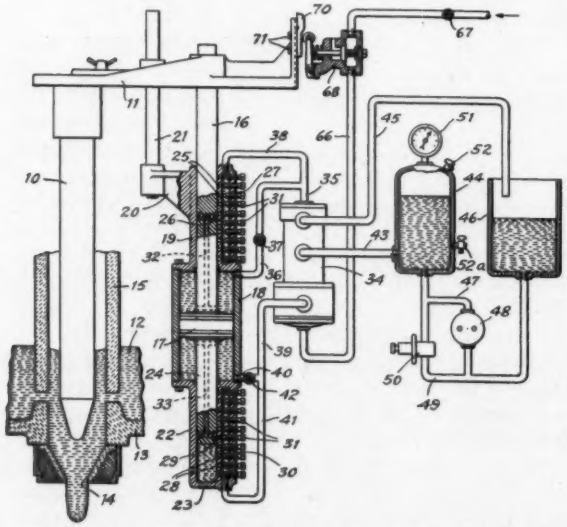


Fig. 3. 2,246,461: Cannon. In the hydraulic cylinder which actuates the feeder plunger 10, numerous needle valves 31, may be controlled individually to give any desired plunger movement.

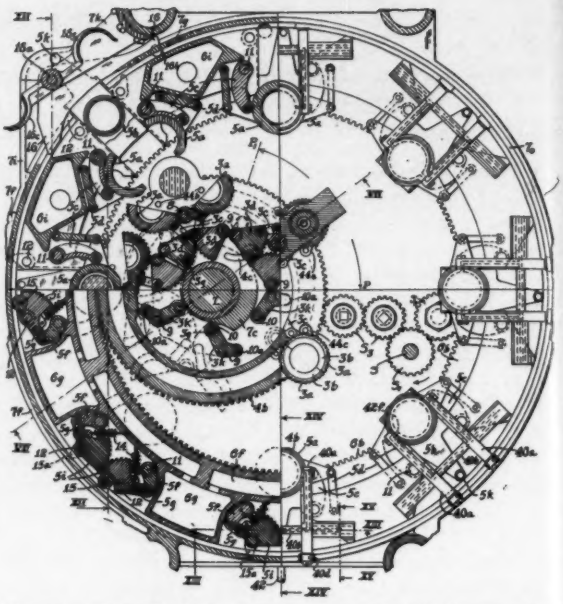


Fig. 4. 2,244,273: Wadsworth. A press-and-blow machine in which the blank is discharged from the inner ringed table to the outer blow mold table at the point of contact of the two tables.

supporting arm 11 is carried by a piston 17 which is given reciprocable action in a vertical hydraulic cylinder.

A novel feature of the invention is the provision of a whole series of ports 25 and 28 at the top and bottom of the hydraulic cylinder, which are individually controllable by needle valves 31 to govern the flow of the pressure fluid. By this arrangement the speed of the plunger may be varied in any portion of its travel.

The G. M. S. Corporation of Pittsburgh was assignee of patent 2,244,809 granted to Theodore H. Sloan of Charleroi, Pa., for a tumbler press. Means for securing such necessary features as (1) coordination of plunger and mold table, (2) variable charge, (3) mold cooling, etc., are described in detail. The mold table is rotated by a Geneva drive, and the plunger is driven by an air cylinder.

A machine for automatically aligning the pairs of glass block sections to form a completed block after bonding material has been applied is described in patent 2,244,291 assigned by Harold L. Eastus of Muncie, Ind., to Owens-Illinois.

The highly detailed view in Figure 4 will only illustrate the general plan of the late Frank L. O. Wadsworth's press-and-blow machine described in patent 2,244,273 (Ball Bros. Co). He described this as an annular ring type of machine with the press molds being carried in an inner ring which intersects at a fixed point an outer ring bearing the press molds. The two rings or tables are geared together so that their linear or peripheral speeds are the same. One object of this arrangement is to permit the transfer of the glass blanks or parisons from the press molds to the blow molds while the table supports are moving at a high speed. The blank enters the blow mold at the inner side and is released on the outside or opposite side of the mold. Another patent application, 2,361, filed January 18, 1935, was referred to by Wadsworth as describing the same type of machine.

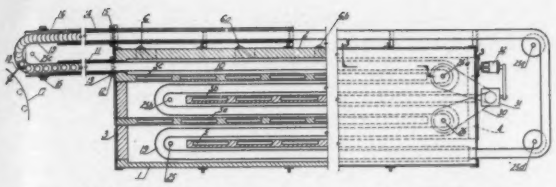


Fig. 5. 2,244,772: Geer. This single-bottle-width lehr receives ware from the machine at 17 and moves it through a series of tunnels of narrow width on an endless conveyor.

Miscellaneous Processes

A stencilling apparatus using a screen and squeegee has been modified by Karl B. Vollstorf of Toledo (Libbey Glass Co.) in patent 2,244,272. Several colors may be applied simultaneously to tumblers, bottles, etc., using any suitable decorating machine such as that described in the H. R. Schutz patent 2,113,605 which issued in 1938. To avoid the necessity of allowing a drying or setting period between the application of different colors. Vollstorf has color partitioning elements within the screen and provides a cam-actuated movement of screen and squeegee which prevents overlapping colors.

Another decoration patent is 2,245,137 assigned by Emanuel Spielholz, New York, to the Duro Test Corp., North Bergen, N. J., for an interior frosted light bulb.

Figure 5 gives an idea of Paul L. Geer's single-bottle-width annealing and decorating lehr described in patent 2,244,772 (Amco Inc., Pittsburgh). Mainly with a view to avoiding the temperature differences across the usual multiple width lehr, Geer provides a tunnel which doubles back on itself several times so that the bottle is carried through several tunnels which are side by side. The ware is carried on an endless belt of special construction.

The burners may be many or few, depending upon the temperature curve desired. Among the advantages of his narrow lehr, Geer cites the sameness of treatment given each article, the great reduction of straight-through drafts, and the fact that closer temperature control due to the treatment of only a single line of articles, makes it possible to heat and cool the ware faster.

Lehrs and their use were also the subject of patents 2,244,112 and 2,244,113 issued to Donald G. Merrill of West Hartford, Conn. (Hartford-Empire Co.), who in 1938 received patent 2,133,783 on similar subject matter. In the lehr of patent 2,244,112 flexibility is such as to allow transverse control of gases to compensate for a condition in which one side of the lehr might tend to run abnormally hot. The rather broad claim 1 covers an annealing method in which the ware passes through a heated section and a cooling section, with the provision that the products of combustion will envelop the ware and will all be exhausted at the ware entering end. The second Merrill patent is particularly directed to decorating lehrs, in which the atmospheric control means may be described as rather elaborate. Hot gases discharged into the lehr below an open-work conveyor may be recirculated in an orbital path, moving from the center at the bottom of the lehr toward the side walls, up the side walls and down through the ware near the center of the tunnel. In general the combustion gases drift toward the ware entering end of the lehr.

Patent 2,244,969, applied for August 16. 1940, by Evan H. Nelson, of Harrow Weald, England, describes a method for sealing conductors into gaseous discharge devices. The patent was assigned to General Electric Co.

Plate and Sheet Glass

Few features of the sheet tempering art have received more attention than the tongs or other means of support which may mar the glass surface during tempering. Two July patents appeared in this field. John P. Pearse of Toledo in patent 2,237,098 (Libbey-Owens-Ford) provides tongs which avoids the usual feature wherein the tip pressure is governed by the weight of the sheet, and instead controls this pressure solely by a wedging mechanism which forces the tongs against the glass. The tongs are released merely by exerting an upward lift on the sheet. In the second tong patent, George P. Despret, Paris, France (American Securit Co., 2,247,289), provides lateral support for the sheet to hold it against distortion during heating, and supports the sheet vertically in a resilient type of grip.

In making bent tempered glass sheets, John L. Drake of Toledo (Libbey-Owens-Ford Glass Co.) avoids tongs as well as vertical support in patent 2,247,118, substituting a roller conveyor which successively carries the sheet through heating, bending and chilling apparatus. Bending is accomplished by the pressure of rolls.

The American Securit Co. was assignee of patent 2,244,715 granted to Bernard Long of Paris, France, for an irregularly tempered sheet. It will be recalled that Long has previously concerned himself with means of overcoming the virtually complete loss of transparency suffered by a sheet of tempered glass when it is fractured. He states that when tempered glass is used as a windshield, the complete fragmentation characteristics of its fracture could impair the driver's vision sufficiently to be highly disadvantageous at the time of an accident. In this latest patent he proposes to produce a zoned temper as indicated by Fig. 6. The highly tempered bands "a" completely surround zones of lighter tempering "b" which would provide greater transparency following a fracture. Long's method of obtaining such a temper is to provide a difference in tempering treatment either on heating or chilling, or both. He might, for example, heat the sheet by numerous heating elements corresponding in placement to the desired patterns.

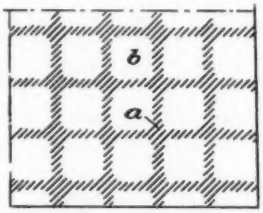


Fig. 6. 2,244,715: Long. A tempered sheet is crisscrossed with zones of lighter tempering "b" which would maintain a greater degree of transparency in a fractured windshield.

A glass sheet inspection device wherein a beam of light passing through the sheet at an acute angle is projected upon a view screen was patented by Frederic L. Bishop, Jr., of Jeannette, Pa. (2,247,047, American Window Glass Co.). Images of any defects such as are caused by stones or stria are said to be readily detected. To aid in classifying the sheets, an illuminated photograph of a standard sheet may be mounted adjacent the viewing screen.

American Window Glass was assignee also of patent 2,246,053 in which Pete Magrini of Belle Vernon, Pa., has suggested means of diminishing waviness in drawn

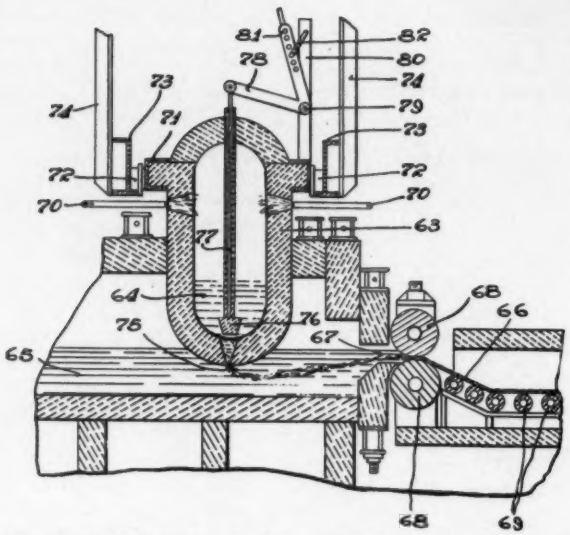


Fig. 7. 2,244,468: Lytle. Heat absorbing glass, released below the surface in a normal glass furnace is carried to the drawing position to form the inner layer of an otherwise normal sheet.

sheet glass. Particularly he intends his improvement to eliminate "batter," the condition resulting from repeated forces striking the surface of the glass sheet and causing indentations. Magrini reports that in a vertical drawing process, these forces are evidently the result of various air currents striking the glass perpendicular to the sheet near the meniscus. Magrini's solution, which is said to greatly reduce batter, consists in exhausting gases from the drawing chamber and providing for the transverse circulation of preheated air from one edge of the sheet to the other, in contact with both surfaces of the sheet near the meniscus.

Figure 7 shows one of the means by which Wm. O. Lytle of New Kensington, Pa. (Pittsburgh Plate Glass Co.), proposed in patent 2,244,468 to obtain a filler or core of a special heat absorbing glass inside a sheet having normal composition. The special glass melted in a separate furnace compartment is released below the surface of normal glass near its drawing point.

Glass Wool and Fiber

Rudolph G. Roesch of Syracuse has patented a method of making glass rope wherein the individual fibers are treated with an aqueous dispersion of vulcanized rubber or other fiber-wetting binder so that they will be less brittle and more flexible during twisting. This is patent 2,245,824, assigned to the Eraser Co. Inc. Other binders for glass fibers to be made into strands are covered by patent 2,245,620, which was issued to Hans Steinbock of Dusseldorf-Gerresheim, Germany (assigned to Owens-Corning Fiberglas Corp.). An example of his binders is an emulsion containing 3 to 10 per cent each of a fatty acid sulphonate, oil, and dextrine.

Whether or not the disclosures made in James F. Hyde's patent 2,245,783 (Owens-Corning Fiberglas Corp.) may prove of economic value, it is at least certain that they will have much scientific interest. Hyde has made the discovery that glass fibers have a marked "base exchange" property; when they are immersed in solutions containing metallic ions such as those of salts of magnesium, lime, zinc, etc. For example, glass fibers made from a soda lime glass having a total alkali content of 16.7 per cent were immersed in a 5 per cent aqueous solution of zinc chloride for a week; at the end of this period analysis showed that the fibers had a total alkali content of 4.11 per cent and that they contained 5.36 per cent ZnO. A similar treatment with stannic chloride gave a treated fiber which had picked up 6.46 per cent tin oxide, SnO_2. The unexpected extent of this reaction is believed by Hyde to be due to the extremely large surface area of fibrous glass.

Base exchange reactions are the basis for zeolite water softeners, and Hyde suggests that glass fibers might be similarly used. Hard water will give up its lime and magnesium to the glass fibers and the fibers can be rejuvenated by soaking in sodium chloride, followed by washing. Only a study of the patent file would show the attitude of the patent office on this aspect of the invention, since the patent itself contains no claims other than the application of Hyde's discovery to a method of coloring fibers. For example, he immerses glass yarn in 5 per cent lead acetate at 85°C. for 24 hours, and then treats them with a 2 per cent potassium dichromate solution at room temperature. The yarn is thereby colored yellow by the formation of lead chromate in the fibers.

NEW BOOK ON GLASS

"Glass: The Miracle Maker." By C. J. Phillips, Corning Glass Works. Pitman Publishing Corporation, N. Y. Profusely illustrated. To be published in September.

The prospectus states that this book will be "an accurate, up-to-date, comprehensive account of the technology of glass, with numerous applications of vital interest to industrial designers and executives, and to engineers. For those outside of industry there is fascinating and unusual material on the characteristics and potentialities."

After taking up the History, the author proceeds to Glass Today, with discussion of the Vitreous State, Preliminary Fundamentals, and Glass Production Statistics. He treats the Chemistry of the Subject; Mechanical Properties; Other Physical Properties; Materials Handling; Fuels, Refractories, Furnaces, and the Melting Process; the Principles of Glassworking; Glass Working Machinery; Finishing, Annealing, Decoration and Inspection. Part Two covers Applications, including Glass in Architecture and Building Construction, Glass in Illumination, Glass in Manufacture, Glass in Science and Research, Fiber Glass.

Orders may be placed by writing THE GLASS INDUSTRY. No price has been set but it is expected to be $4.50.

• It is reported from reliable sources that the Argentine Trade Treaty is being reviewed by the Argentine Government prior to affixing the signatures which is understood will take place at the end of August. No announcement of the official text has been made in accordance with the usual procedure of the State Department in these matters. Whether or not glass is included in this treaty is undeterminable at this time.

USE THE CALORIMETER FOR COMBUSTION CONTROL

Modern glass practice requires complete control of all variables from batch materials to inspection and packing. Mixing of batch; furnace charging; combustion and temperature in furnace, forehearths, feeders and lehrs; voltage of power lines; air pressure for machine operation and mold cooling; to mention some of the more important variables, should be under constant control, if high quality glassware is to be packed at uniformly high rates of selection. To Management, such results mean maintenance of profit.

As processes are refined, minor variations formerly regarded as unimportant must be recognized, measured and brought under control. "Tying down" one set of conditions usually brings into the open other varying conditions, and correcting the latter in turn may shift the emphasis back to further refinements in the initial conditions or lead to changes in other directions. Obviously, the use of instruments is a highly essential part of this program to constantly increase operating efficiency. Actual measurement of a variable is the first step toward correction or control.

It is rather interesting to note the progress that has been made in combustion control during recent years, and its effect on maintenance of proper temperature and efficient use of fuel. When both fuel and combustion air are metered, two primary steps have been taken in combustion control. Metering gaseous fuel obviously gives a measure of the volume introduced, let us say, into a melting furnace. What we are really interested in, however, is the number of heat units introduced into the furnace and to maintain this, for given temperature conditions, at a constant value per unit of time. We usually assume, tacitly, that the B.T.U. content of the fuel per unit volume is constant, and for natural gas this assumption is usually justified. If there is doubt, however, the heating value can be readily determined by using a continuous, recording, fuel calorimeter.

As is well known, the calorimeter is used to determine and record, in B.T.U.'s, the calorific value of any gaseous fuel. One of the better known types of calorimeters, The Thomas Meter (Cutler-Hammer), gives results direct in B.T.U.'s per cubic foot of gas, at 30" mercury pressure and 60° F. saturated, without manual operation, computation, or correction of any kind. The results are permanently and graphically recorded, and can be shown at one or more points throughout the plant.

The basic principle of operation of this calorimeter has been retained since the original was designed. As in the initial design, gas is burned at a constant rate and the heat developed is absorbed by a stream of air. The rates of flow of gas, combustion air, and heat absorbing air are regulated by water sealed metering devices geared together and driven by an electric motor, so that the ratio of gas to air is maintained constant. The products of combustion are kept separate from the heat absorbing air and are cooled very nearly to the initial tank temperature, so that the water formed in the combustion is condensed to the liquid state. Thus the rise in temperature of the heat absorbing air is a measure of the heating value of the gas. This rise in temperature is measured by a pair of Nickel wire resistance thermometers, translated into B.T.U. per cubic foot and automatically recoded. For a diagrammatic sketch of this calorimeter see Fig. 1.

At one plant where a very complete combustion control system had been installed on a melting furnace, fired with natural gas, a Thomas Calorimeter was used to obtain exact data on fuel value for studies on furnace efficiency. The data so obtained indicated a fairly wide fluctuation in B.T.U. content—sufficient to require sizable adjustments to maintain correct temperature and combustion conditions. This particular glass plant drew its gas from a field of small wells which yielded a gas of approximately 89 per cent methane, and 11 per cent ethane. The variation in calorific value, shown in the table presented below, applied at that time to this particular field and is, of course, not to be taken as applying to natural gas from other fields nor, in fact, to this local field today. The data are presented for the purpose of pointing out an unusual source of variation in a plant where all variables were considered to be under close control. Without the recording calorimeter this variable would have been extremely difficult to find.

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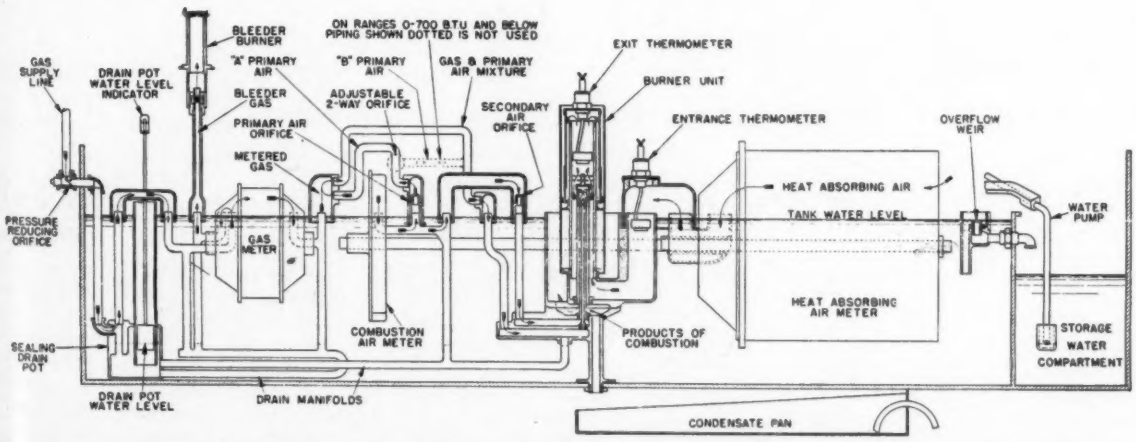


Fig. 1. Diagrammatic sketch of the operation of a Calorimeter. Illustration by courtesy of the Cutler-Hammer Co.

CURRENT STATISTICAL POSITION OF GLASS

During June glass manufacturers maintained May's record rate of activity; production, employment and payrolls remained at the record peaks established in the previous month. According to THE GLASS INDUSTRY'S Production Index June's output totaled $27,000,000, bringing the half year total close to $217,000,000 as compared to $175,000,000 during the first six months of 1940.

Plate glass production during June totalled 18,533,516 square feet, according to the Plate Glass Manufacturers of America. This was slightly more than the May total, but exceeded June 1940 by 91 per cent. During the first six months of 1941 plate glass output totalled 108,552,660 square feet, which was 38 per cent greater than 1940's comparable figure.

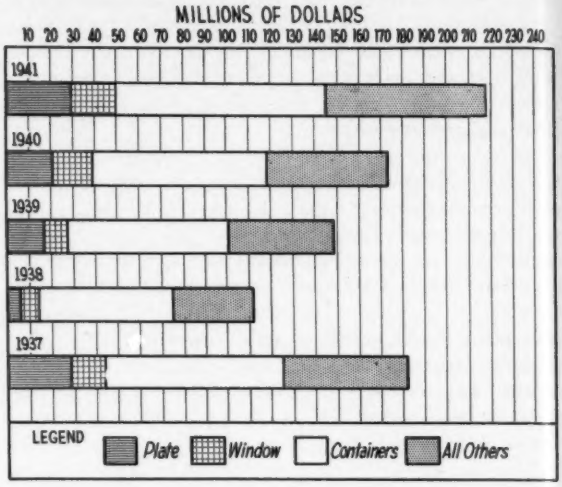
Window glass production during June equalled the May volume, recording a total of 1,304,221 boxes, which represented 80.3 per cent of the industry's total capacity. As compared with this, June 1940 production was 907,865 boxes, which represented 55.9 per cent of the industry's capacity. Output in the window glass industry during the first half of 1941 amounted to 10,361,000 boxes, or 56 per cent greater than last year.

Glass container production during June totalled 6,165,606 gross, according to the Glass Container Association of America. This was only slightly less than the record volume produced in May, but exceeded the June 1940 output by 39 per cent. During the first half of 1941 a record total of 31,750,118 gross glass containers were produced—59 per cent more than last year's total of 19,338,161 gross.

Shipments of glass containers during June exceeded last year's corresponding total by 31 per cent, having increased to 6,834,923 gross. All types of containers, with the exception of beer bottles, moved in larger quantities with greatest gains noted in general purpose ware (up 76 per cent), domestic fruit jars (up 65 per cent), wide mouth food containers (up 54 per cent), pressed food ware (up 53 per cent) and medicinal and toilet ware (up 50 per cent). Total shipments for the first 6 months of 1941 were reported to have been 32,406,346 gross—24 per cent ahead of last year. Details of this

THE GLASS INDUSTRY'S INDEX

Production: Six Months, January Through June



trade indicate that all types of containers were shipped in greater volume during this period. Sales of domestic fruit jars jumped 105 per cent, while gains in other lines ranged from 9 to 38 per cent.

Stocks of glass containers on hand June 30, 1941, totalled 8,397,234 gross—a drop of 9 per cent from 1940's corresponding figure. Inventories of all types of ware with the exception of beer bottles and liquor ware were below their 1940 levels. Domestic fruit jars were off 44 per cent, pressed food ware 28 per cent, narrow neck fod containers 20 per cent and milk bottles 19 per cent; other decreases ranged from 9 to 13 per cent.

Miscellaneous glass products manufactured during June had a value of $12,000,000, which was equal to the May total and exceeded June 1940 by 20 per cent.

Production of automatic pressed tumblers during June amounted to 4,856,975 dozens or 33 per cent greater than last year's corresponding figure. During the first half of 1941 production of these items increased 12 per cent

CURRENT GLASS CONTAINER STATISTICS

(ALL FIGURES ARE IN GROSS)

Types of Ware	*Production*		*Shipments*		*End of Month Stocks*	
	June, 1941	*June, 1940*	*June, 1941*	*June, 1940*	*June, 1941*	*June, 1940*
Food Containers (Narrow neck, wide mouth and pressed)	1,710,150	1,253,391	1,850,858	1,239,445	1,892,368	2,122,305
Pressure and Non-Pressure Ware	659,030	526,645	763,019	640,164	592,766	625,682
Beer Bottles	475,553	353,237	605,451	780,977	711,222	530,671
Liquor Ware	1,002,507	713,655	1,028,124	843,001	1,317,143	1,272,796
Medicinal and Toilet Ware	1,517,322	1,068,112	1,694,873	1,130,601	2,748,261	3,119,355
General Purpose	422,427	249,866	476,625	271,297	480,010	551,317
Milk Bottles	270,074	201,793	262,095	200,253	281,320	346,489
Fruits and Jellies	89,440	39,358	165,307	101,854	334,843	574,882
All Others	19,094	20,560	18,571	18,580	39,301	36,090
Total Industry	6,165,606	4,426,617	6,864,923	5,226,172	8,397,234	9,179,587

above the previous year's level to 25,338,445 dozens. Shipments of automatic tumblers were 34 per cent greater in June 1941 than in 1940's corresponding month; this brought the six months' total 15 per cent ahead of last year's figure to 25,374,280 dozens. Inventories of this ware as of June 30, 1941, amounted to 7,820,398 dozens —an increase of 3 per cent over last year.

Manufacturers' sales of machine made table, kitchen and household glass ware were reported to have totalled 3,069,023 dozens in June, which is 41 per cent above the June 1940 level. During the twelve month period ending June 30, 1941, this trade totalled 36,270,704 dozens as compared to 34,280,421 dozens in the previous twelve month period.

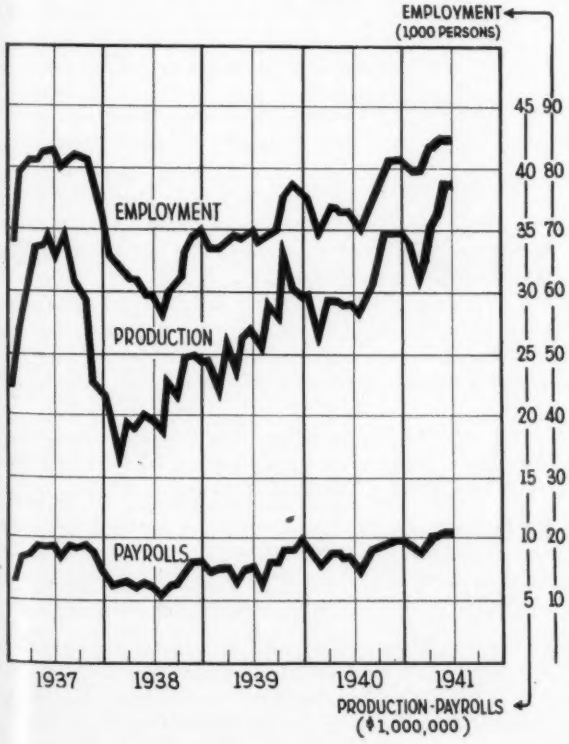
According to a preliminary release of the Bureau of Census, thirteen illuminating glassware manufacturers reported sales totalling $867,000 during June 1941, which was 2 per cent less than their May business, but was 52 per cent more than their June 1940 sales.

Employment and Payrolls: Little change was reported in the labor situation in the glass industry during June, so it is estimated that the May record employment total of 86,000 persons was maintained. This compared with 72,600 persons in June 1940.

Payrolls in the glass industry during June equalled the May total of $10,900,000; last year's corresponding total was $8,100,000. During the first half of 1941 glass manufacturers paid out $61,500,000 to their employees as compared to $50,000,000 last year.

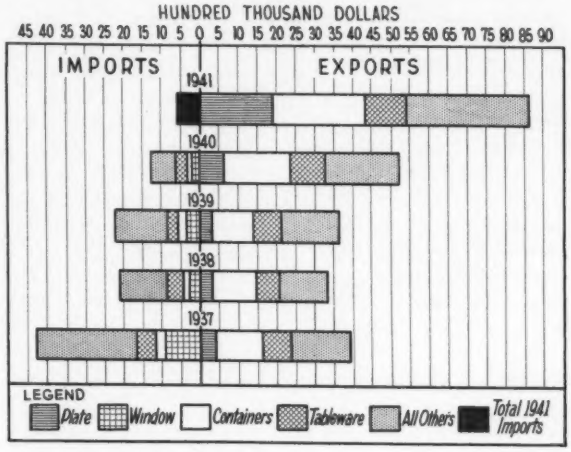
THE GLASS INDUSTRY'S INDEX

Monthly Trends Through June, 1941



THE GLASS INDUSTRY'S INDEX

Foreign Trade: Five Months, January Through May



Foreign Trade: Exports of glass and glass products totalled $1,882,000 during May, according to official figures released July 21 by the Department of Commerce. This was an increase of 12 per cent over the April total and exceeded May 1940 by 60 per cent. Increases over the previous month were reported for all types of ware with the exception of window glass, which dropped 8 per cent. Compared with May 1940, plate glass was up 24 per cent, containers 71 per cent, and illuminating ware 40 per cent; table ware exports were down 5 per cent, but window glass sales were 8 times the previous year's total. During the five-month period ending May 31, 1941, foreign sales of glass products totalled $8,607,000, as compared to $5,259,000 in last year's comparable period.

Imports of glass and glass products during May dropped 40 per cent below the April total to $94,000; this was 56 per cent less than in May 1940.

FOREIGN TRADE STATISTICS

(VALUES IN $1,000)

Exports	*May* 1941	*April* 1941	*May* 1940
Plate	163	148	132
Window	194	211	24
Containers	594	462	348
Tableware	238	191	247
Illuminating ware	81	72	58
All other	612	596	360
Total	1,882	1,680	1,169
Imports			
Total	94	156	216

COMMITTEE REAPPOINTED

The National Research Council has reappointed the Committee on Chemical Data for Ceramists for the year 1941-42. The members of the Committee are: Dr. Frederick D. Rossini of the National Bureau of Standards and Dr. George W. Morey of the Geophysical Laboratories, with Dr. Alexander Silverman of the University of Pittsburgh as Chairman.

FESTIVAL OF THE RED ROSE

On June 8 the annual "Festival of the Red Rose," commemorating the gift of Baron Stiegel, glassmaker and ironmaker, to the Lutheran inhabitants of Manheim, Pa., was celebrated in that city. This makes the 49th consecutive year that this quaint ceremony, provided for by the deed of this famous old glassmaker and great industrialist of Revolutionary times, has been perpetuated, and the occasion is carefully observed by antique collectors and all who follow closely the history of Stiegel glass.

Baron Stiegel, besides being a glassman of note, was intensely religious, heading regular services for himself and his glassworkers in a chapel on the second floor of his Manheim home. In 1772, he made a gift of a plot of ground to his fellow Lutherans, upon which they might erect their church. In the deed it was stipulated "in the month of June yearly hereafter the rent of One Red Rose."

The plot of ground contains to this day the place of worship of the Zion Evangelical Lutheran Church, the pastor of which is Rev. J. F. Knittle. The credit for continuing this old tradition of the Red Rose belongs in large measure to him.

At the services in June, Judge Cyrus M. Palmer, Judge of Schuykill County Courts, Pottsville, Pa., gave a red rose, according to the deed, to Mrs. Helen Robertson Black of Sewickley, Pa., whose mother is the oldest living heir of Baron Stiegel. Roses were also presented to others attending the service.

Memorial services were attended by people from many parts of the country, which crowded the auditorium and annex of the church to capacity.

(Right) Judge Cyrus M. Palmer presents the red rose to Mrs. Helen Robertson Black.

(Left) The Rev. C. C. Rasmussen delivers the memorial address.

EBG MERGES WITH NIAGARA ALKALI

Niagara Alkali Company and Electro Bleaching Gas Company, two affiliated firms widely known throughout the chemical world for their pioneer activities in the field of alkalies and liquid chlorine, announce that they have joined forces and beginning July 1st they will operate as one organization under the name of Niagara Alkali Company. Announcement is also made of the election to the presidency of Niagara Alkali Company of J. Clarke Cassidy, formerly works manager. Niagara Alkali manufactures caustic soda, caustic potash, carbonate of potash and paradichlorobenzene at its plant in Niagara Falls, N. Y. Electro Bleaching Gas Company, at its adjacent plant, produces liquid chlorine by the electrolytic method.

Both EBG and Niagara are famous for their pioneering work in their specialized fields. EBG was the first American company to produce liquid chlorine, and was formed in 1907 for that purpose. The company introduced the use of liquid chlorine as a bleaching agent to the textile, pulp and paper, and the shellac industries. One of its outstanding achievements, however, was the adaptation of liquid chlorine to the purification of water supplies and the sterilization of sewage. Niagara Alkali Company was the first in America to produce caustic potash. Recently, Niagara pioneered again and became the first American producer of carbonate of potash, used chiefly in the glass industry for the manufacture of fine glassware.

GLASS STOPCOCKS

An extremely readable little treatise on glass stopcocks, covering their construction and use in the laboratory as part of scientific apparatus, has been written by Martin Shepherd and published as U.S. Bureau of Standards Circular C430.

The author is a firm believer in ground glass stopcocks, and takes exception with those chemists "who stoutly maintain that a stopcock is a located leak." He has known a single stopcock to maintain a vacuum (0.0002 mm Hg) for a period of 1 year, within a 22-liter flask used as a stratosphere sampler.

As a matter of fact, the real possibilities of these useful tools have probably scarcely been explored, for by deviating from conventional design, stopcocks can be produced capable of meeting all sorts of unusual requirements.

The types of stopcocks are described and illustrated, methods of construction are discussed, and directions are given for grinding, lubrication, and general care.

- The Stained Glass Association of America held its annual convention June 23 and 24 at the Hotel Prichard, Huntington, W. Va. A feature of the convention was a visit to the Blenko Glass Co. at Milton, W. Va.

- The annual wage conferences between the Glass Bottle Blowers Association and the manufacturers of glass containers will be held at the Marlborough-Blenheim Hotel, Atlantic City, beginning August 4.

NEW EQUIPMENT AND SUPPLIES

SPEEDMATIC SAW

The Porter-Cable Machine Company, Syracuse, New York, announces another addition to their line of Speedmatic Saws. This new machine carries a 6½ inch diameter blade, with cutting capacity of 2 inch material, yet weighs only 15½ pounds. The blade travels at 7200 r.p.m., producing a cutting edge speed in excess of two miles a minute.

It is said by the manufacturer that through the use of the helical cut gear drive in this tool 98 per cent of the motor power is transmitted to the driveshaft in comparison with the usual 76 per cent delivered in worm gear driven high speed saws. This model is designated as Type K-65. It is perfectly balanced and equipped with a ⅝ h.p. Universal motor. The base raises and lowers for depth adjustment, and tilts to 45 degrees for bevels. A cast in and enameled graduated scale affords quick and accurate setting. The frame is die cast aluminum, polished to a mirror finish. Standard equipment includes a combination saw blade, ripping guide, cross cutting guide, 15 feet insulated conductor cable with plug and socket, metal carrying case, and blade change wrench.

PAASCHE AIRBRUSH

A line of automatic spray type lubricating devices suitable for use with lubricants containing dispersions of colloidal graphite has been made available by Paasche Airbrush Co., Chicago, Illinois. The devices are designed to spray the lubricant on working surfaces automatically, and are provided with a universal mounting making it possible to easily and quickly adjust the lubricator to any desired position or angle, thus insuring uniform coverage.

A feature of the Paasche automatic air operated Airbrushes is that the air operated pistons controlling the spraying action can be started and stopped virtually instantaneously providing accurate regulation of the amount of colloidal graphite lubricant sprayed on with each "shot." Furthermore, the design is such that intermittent operations as high as 150 shots per minute can be obtained if desired. The automatic airbrushes operate on a minimum of 35 lbs. air pressure. A double action valve allows air to be discharged before the fluid needle valve is opened and air remains on until after the fluid needle seats. This assures perfect atomization of the colloidal graphite carrier. Seating of the fluid needle is positive, sealing the lubricant in so well, it is said, that it can be retained in the gun and fluid line indefinitely without congealing or clogging, eliminating the necessity of cleaning and wastage of material in case of protracted shut-downs of the equipment on which the airbrushes are installed.

The automatic airbrushes can be regularly supplied with any one of three sizes of fluid assemblies for light average or fast application, and with various sizes of multipleheads. Multiple heads are adjustable for fan or cone spray. The latter permits adapting the spray guns to any of the carriers commonly used in preparing dispersions of Acheson colloidal graphite—including "oildag" (Acheson colloidal graphite carried in oil); aquadag (colloidal graphite carried in water); as well as low viscosity carriers such as kerosene, carbon tetra-chloride, etc.

The latter types have recently been developed as the result of availability of more finely divided forms of Acheson colloidal graphite, and are particularly suitable for lubricating surfaces where high temperatures mitigate against the use of liquid lubricants. When applied in this manner, the carrier evaporates, leaving a "dry film" of lubricating graphite.

NEW FIRE BRICK LINE

A new line of insulating fire brick for the temperature range from 1600 to 2600 degrees F. has been announced by Johns-Manville, and designed for direct exposure in a wide variety of furnaces, oven and other heated equipment, except where subject to slag action or mechanical abuse. The brick are produced from a plastic refractory clay and an organic filler which, upon being burnt out during the manufacturing process, gives a uniform, controlled pore structure to each of the various types, and imparts the characteristics of light weight, strength, and high insulating value.

The brick are furnished in four temperature limits: JM-16, for exposed service to 1600 deg. F. and for back-up service to 2000 deg. F.; JM-20, JM-23, and JM-26 for exposed or back-up temperatures to 2000, 2300 and 2600 deg. F., respectively.

Production of the new brick has been recently started at Zelienople, Pa., in J-M's newest plant, which was rushed to completion ahead of schedule to meet the need for such materials in the industrial expansion program for defense.

METLSEEL

The Porcelain Enamel and Manufacturing Company has developed a material, called Metlseel, which is said to prevent corrosion and disintegration of metal parts exposed to gaseous atmospheres at furnace temperatures. Metlseel, which is applied as a liquid coating, withstands heat in excess of 1500 degrees F., and prevents oxidation and keeps the metal parts sound and clean. With the increasing difficulty of obtaining heat-resisting alloy steels due to priority rulings, it is believed that this new liquid will be of interest to the heat-treating industry.

INDUSTRIAL MULTI-BREAKER

A new 230 volt industrial Multi-Breaker, at little more than the cost of a type A switch, has been announced by Cutler-Hammer, Inc. The breaker is fuseless, with bi-metallic strip actuation, visible trip indication, and trip free lever. It is quick make and quick break, with a rated capacity of 230 volts from 15 to 100 amperes, and available in 3 pole, 3 pole solid neutral or 4 pole solid neutral types. Calibration is set at the factory and cannot be tampered with. The breaker is completely enclosed and semi-dust-tight. Front access and operation make this breaker convenient, compact and economical of space.

CATALOGS RECEIVED

The Gaertner Scientific Corp., Chicago, Ill. A 12-page bulletin, 151-14, on the L254 Spectrograph summarizing the major new features and giving a general description of the instrument. The instrument is a large two-lens quartz spectrograph with Cornu prism.

Johns-Manville, New York, N. Y. A 10-page data book, DS Series 585, on Marinite for oven and drier construction. Marinite is a fire-proof panel material with high insulating characteristics. The data book describes ovens, driers and lehrs with detailed drawings.

Corning Glass Works, Corning, N. Y. The new Pyrex Laboratory Catalog No. LP-21, with 160 pages and listing approximately 2700 items. Many of the new items include Pyrex brand Fritted Ware and Vycor brand Laboratory Ware. It is stated that this catalog is the most comprehensive in the company's history.

Glass Container Association of America, New York, N. Y. A booklet which tells the complete story, with a blue-print, of the 2 lb. Tabl-Serv Preserve Jar, recently designed for the Army. The booklet was prepared for and sent to Post Quartermasters for their information.

Sommer and Maca Glass Machinery Corp., Chicago, Ill. A 148 page catalog emphasizing "everything for replacing automobile glass" which also includes 16 pages describing wet abrasive belt machines for edging, beveling and polishing of flat glass.

CATALOG & BULLETIN SERVICE

Current catalogs and manufacturers' service bulletins reviewed in this department may be obtained by writing to THE GLASS INDUSTRY.

CURRENT PRICES OF GLASS-MAKING MATERIALS

FURNISHED BY PRODUCERS, MANUFACTURERS AND DEALERS

Base Materials

		Carlots	Less Carlots
Barium carbonate ($BaCO_3$), Crude, (Witherite)			
90%, 99% through 200 mesh	ton	45.00	48.00-51.00
Precipitated material		47.50	52.50
Barium sulphate, in bags	ton	19.00	24.00
Barium sulphate, glassmaker's, carlots, bulk f. o. b. shipping point	ton	15.00-16.00	18.00
Borax ($Na_2B_4O_7 10H_2O$)	lb.	....	....
Granulated	In bags, lb.	.0215	.027 -.0295
Powdered	In bags, lb.	.024	.0295-.032
Boric acid (H_3BO_3) granulated	In bags, lb.	.048	.054 -.0565
Calcium phosphate ($Ca_3(PO_4)_2$)	lb.	.07	.07½
Cryolite ($Na_3Al\ F_6$) Natural Greenland (Kryolith)	lb.	.0865-.0875	.0925
Synthetic (Artificial)	lb.	No supplies available.	
Feldspar—(published list prices)			
20 mesh	ton	11.00-13.25	
40 mesh	ton	11.50-13.75	
Granular	ton	11.75-14.00	
Semi-granular	ton	11.00-13.25	
L. C. L., (Min. 2 tons) $3.00 per ton additional plus charge for bags			
Fluorspar (CaF_2) domestic, ground, 96-98% (max SiO_2, 2½%)			
Bulk, carloads, f. o. b. mines	ton	30.00	....
In bags	ton	31.60	42.00-45.00
Kryolith (see Cryolite)			
Lead Oxide (Pb_3O_4) (red lead) (N. Y.)	lb.	.0835	....
In 5 Ton lots	lb.	....	.0875
Less than 5 Tons	lb.	....	.0925
Lime—			
Hydrated ($Ca(OH)_2$-MgO) (in paper sacks)	ton	8.50	8.50
Burnt (CaO-MgO) ground, in bulk	ton	7.00	....
Burnt, ground, in paper sacks	ton	9.00	9.00
Burnt, ground, in 180 lb. drums	Per drum	1.60	1.70
Kiln Dried ($CaCO_3$-$MgCO_3$) 10x30 mesh	ton	1.75	....
Kiln Dried ($CaCO_3$-$MgCO_3$) 16x120 mesh	ton	1.75	....
Nepheline Syenite, f. o. b. shipping point	ton	12.00	15.00
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.065	.0675
Hydrated 80-85%	lb.	.065	.0675
Salt cake, glassmakers (Na_2SO_4) in bags	ton	18.00-20.00	25.00
in bulk		16.50	
Soda ash (Na_2CO_3) dense, 58%—			
Bulk	Flat Per 100 lb	.95	....
In barrels	Per 100 lb.	1.35	....
In bags	Per 100 lb.	1.10	....
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls	Per 100 lb.	....	3.00-3.40
95% and 97%			
Bulk	Per 100 lb.	1.35	....
200 lb. bags		1.44	1.465
100 lb. bags		1.475	1.50

Special Materials

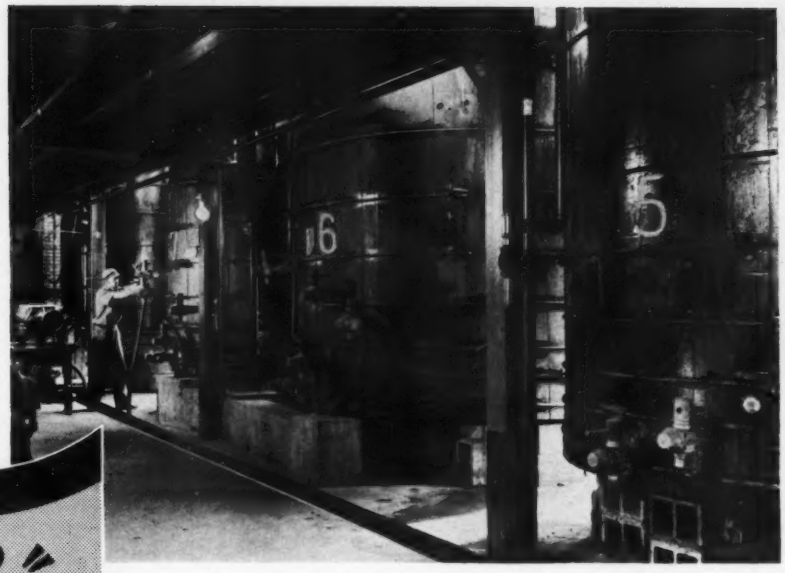
		Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)	lb.	.026-.029	.04
Aluminum oxide (Al_2O_3)	lb.	.	09
Antimony oxide (Sb_2O_3)	lb.	.14	.14½
Arsenic trioxide (As_2O_3) (dense white) 99%	lb.	.03½	.04½
Barium nitrate ($Ba(NO_3)_2$)	lb.	....	Open price.
Pyrophyllite, (20% Al_2O_3)	ton	9.00	12.00
Sodium fluosilicate (Na_2SiF_6)	lb.	....	
Tin Oxide (SnO_2) in bbls	lb.	....	.55
Titanium Oxide (ceramic grade)			
In bags	lb.	.14½	.14¾-.15¼
In barrels	lb.	.14¾	.15 -.15½
Zinc Oxide (ZnO)			
American process, Bags	lb.	.07	.07¼
White Seal, 150 lb. bbls	lb.	.09	.09¼
Green Seal bags	lb.	.08¼	.08½
Domestic White Seal bags	lb.	.08¾	.09
Red Seal, bags	lb.	.07¾	.08
Zircon			
Refined Granular (Milled .01-.02c higher)		.06½	.07-.08

Coloring Materials

		Carlots	Less Carlots
Barium selenite ($BaSeO_3$)	lb.	....	1.40-1.60
(Commercial. 25% Selenium)	lb.	....	.85
Cadmium sulphide (CdS)	lb.	....	1.10-1.15
Cerium hydrate—			
100 lb. drums and 600 lb. barrels	lb.	....	.60
Chrome Oxide Green, 400 lb. bbls.	lb.	....	.25-.28
Chromite (99% through 200 mesh)	ton	55.00	58.50
Chromite ore (air floated)	ton	55.00	58.00-73.00
Cobalt oxide (Co_3O_4)			
In bbls. 350 lbs. or more,	lb.	....	1.84
Less than 350 lbs.,	lb.	....	1.94
Copper oxide—			
Red (Cu_2O)	lb.	....	.20-.22
Black (CuO)	lb.	....	.19-.22½
Black prepared	lb.	....	Open price
Iron Oxide—			
Red (Fe_2O_3)	lb.	....	.05½-.06¾
Black (Fe_3O_4)	lb.	.04½	.09
Iron Chromate	lb.	....	.035-.05
Lead Chromate ($PbCrO_4$) in bbls	lb.	....	.145
Lithium Carbonate	lb.	....	1.25
Manganese, Black Oxide (Caucasian)			
In Paper bags	ton	70.00	78.00
In Burlap bags	ton	71.75	79.75
In Casks	ton	74.00	82.00
Neodymium oxalate, 50 lb. drums	lb.	....	4.00
Nickel oxide (Ni_2O_3), black	lb.	....	.35-.40
Nickel monoxide (NiO), green	lb.	....	.35-.37
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals and Granular	lb.	.10	.10¼-.10½
Powdered	lb.	....	.10¾-.11
Potassium Chromate (K_2CrO_4) 100 lb. kegs	lb.	....	.27
Powder blue	lb.	....	.21-.25
Rare earth hydrate—			
100 lb. drums	lb.	....	.35
325 lb. barrels	lb.	....	.30
Selenium (Se) In 100 lb. lots	lb.	....	1.75
In lesser quantities	lb.	....	1.85
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07½	.07
Sodium chromate (Na_2CrO_4) Anhydrous	lb.	.09½	.09½-.09½
Sodium selenite (Na_2SeO_3)	lb.	....	1.50-1.65
Sodium uranate (Na_2UO_4) Orange	lb.	....	1.65
Yellow	lb.	....	1.65
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.35	3.70-4.10
Flowers, in bags	Per 100 lb.	3.00	3.35-3.75
Flour, heavy, in 250 lb. bbls.	Per 100 lb.	2.90	3.25-3.65
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots. Black	lb.	....	2.55
Yellow orange	lb.	....	1.65

Polishing Materials

		Carlots	Less Carlots
Emery, Turkish	lb.	.072	.08
Pumice Stone,			
American Ground Italian FFF, FF, F	lb.	....	open price
0, 0½, ½, 1.	lb.	....	open price
Putty Powder	lb.	Open price.	
Rotten Stone, (Domestic)	lb.	02¼	.03½
Rouge, Red	lb.	....	.16
Black	lb.	....	.18



One row of the large precipitating tanks holding thousands of gallons of materials in process. This is just one portion of the specialized equipment designed and installed by "Ceramic" engineers which enables "Ceramic" to meet the unusual present demands.

"Ceramic" COLORS AND CHEMICALS

We Can Supply
Your NEEDS

Each year since our beginning, we have experienced an increased demand over the previous year for colors and chemicals. In planning and building to meet these normal annual increases, we have anticipated future increases and expanded accordingly.

Today our equipment and personnel are at the peak of efficiency. Our warehouses are stocked with reserves of raw materials. In this period of unusual demand "Ceramic" has ample production facilities to serve the glass industry.

This is your assurance that "Ceramic" service is as dependable as ever.

Glass Colors

Vitrifiable Colors for Banding, Spraying and Screening; Alkali-resisting, Acid-resisting, Satin Finish, High Fire Convexing, Low Fire and Squeegee Colors; White or Colored Weather-resisting Enamels; Colored or Crystal Ices.

Oils

Balsam Copaiba, Damar Varnish, French Fat Oil, Ground Laying Oil, Oil of Copaiba, Printing Oil, Squeegee Oils for Low Fire, High Fire or Overlapping Work, Venice Turpentine.

Chemicals

Aluminum Hydrate, Antimony Oxide, Arsenic Oxide, Barium Carbonate, Bone Ash, Cadmium Sulphide, Cerium Hydrate, Chromium Oxide, Cobalt Oxide, Copper Oxide, Iron Chromate, Iron Oxides, Fluorspar, Cryolite, Manganese Dioxide, Powder Blue, Potassium Bichromate, Sodium Uranate, Sodium Selenite, Selenium, Titanium Dioxide, Zinc Oxide.

"Ceramic" COLORS
CERAMIC COLOR & CHEMICAL MFG. CO.
NEW BRIGHTON, PA., U.S.A.

YOUR

GLASS MANUFACTURING

PROBLEMS ARE

OURS

. . . ours in the sense that we feel we can be of genuine service to you . . . ours in the sense that your problems are held in the strictest confidence, both by our organization and by our men who work with you.

Solvay Technical Service is composed of men who can give you more than mere opinions. You will find that their reports contain sound, well-thought-out solutions to your problems . . . solutions which could only be based on practical knowledge gained through years of specific experience in your field.

We would like you, as a glass manufacturer, to make the utmost use of Solvay Technical Service . . . to get the benefit of a competent, outside viewpoint on your glass manufacturing problems, especially as they relate to the use of alkalies. When problems arise, please do not hesitate to write us. Write to the nearest Solvay Office listed below.

60th ANNIVERSARY 1881 1941

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 RECTOR STREET NEW YORK, N. Y.

BRANCH SALES OFFICES:

Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit
New Orleans • New York • Philadelphia • Pittsburgh • St. Louis • Syracuse

Plants Located At:

Syracuse, N. Y. • Detroit, Mich. • Baton Rouge, La. • Hopewell, Va.

SOLVAY

TRADE MARK REG. U. S. PAT. OFF.

TECHNICAL SERVICE

USE THE CALORIMETER

(*Continued from page* 353)

A five and one-half months' record gross in B.T.U.'s per cubic feet from December 1939 to the middle of May 1940, taking the low and high values and striking an average, is as follows:

	Low	*High*	*Average*
December 1939	990	1068	1035
January 1940	1048	1085	1058
February 1940	1045	1125	1075
March 1940	1015	1133	1070
April 1940	1050	1088	1071
May 1940	1050	1103	1068

If such changes occurred very gradually they might well have been overlooked but as shown in the following chart the variation from day to day was rather striking.

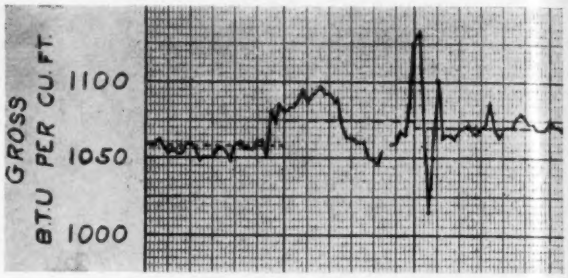


Chart taken from the actual operating records of a glass container manufacturer showing the variation in gross B.T.U. per cu. ft. of natural gas delivered to the melting furnace. Period is for the first three months of 1940.

A change in calorific value of gaseous fuel applied to forehearth firing would call for adjustment of fuel input to maintain desired temperature. Minor variations might well be masked by other variable but—to repeat—as practices are refined these minor variations loom larger and larger and for maximum efficiency of operation they must be controlled.

"INDIVIDUALIZED" CONTAINERS

The Kimble Glass Company, at their Chicago Heights, Ill., factory, is designing and producing a new type of moulded bottle which is being advertised to the trade as "Individualized" glass containers, "for packages of distinction." Each container is designed specifically for the manufacturer's own purpose, and is not duplicated for anyone else.

GLASS SLICING MACHINES

• We manufacture a variety of wet glass slicing machines for solid glass bars, glass tubing, etc. We can also supply a full line of special glass working machinery for the production of television tubes, fluorescent tubes, incandescent lamps, glass ampules and vials. Glass working lathes and laboratory equipment of all kinds. Cross Fires and Torches. Ask for our catalogue.

•

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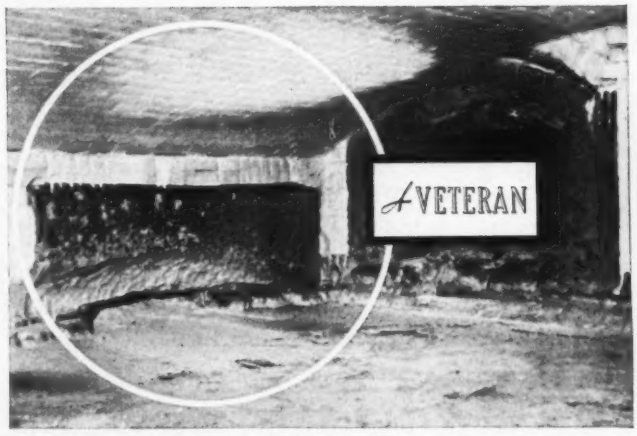
CHAS. EISLER, Pres.
742 SOUTH 13TH STREET
(Near Avon Avenue)
NEWARK, N. J.

A VETERAN

OF A LONG CAMPAIGN returns TO THE FIRING LINE

...retired after a hard campaign of 19 months "Veteran" P. B. SILLIMANITE Blocks are recalled to active duty on the firing line.

"The P. B. SILLIMANITE Dog House Arch—Mantel Block—Ports and Tuckstones in this End Port OIL FIRED CONTINUOUS TANK were photographed when the unit was shut down for repair after running 19 months. A refractory of the same general class as P. B. SILLIMANITE was used for the tank repair, but after running some 8 months the Mantel Arch and Mantel Block had failed and a hot repair was necessary. Fortunately, the old P. B. SILLIMANITE Dog House Arch was never thrown out so the repair was made with minimum delay. The P. B. SILLIMANITE Arch shown here has now added another 6 months to its record—and it's still going strong! Here's one time when its an honor to be in the "Dog House."



Let's look at the record together. You will find that P. B. SILLIMANITE is T-H-E refractory for service in the upper-structure of *OIL FIRED FURNACES.*

CHAS. TAYLOR SONS Co.

MANUFACTURERS OF REFRACTORIES • CINCINNATI • OHIO • U. S. A.

CERAMICS BROCHURE

A brochure titled "Ceramics—What Is It, What It Offers as a Career" has been prepared and is being distributed under the auspices of the Illinois Ceramic Institute. The purpose of this publication is to arouse interest in this industry among high school teachers and pupils and lists the opportunities in ceramics; the abilities one should have to enter this field; and some information telling about the ceramic industry's major divisions, and tells where in Illinois to receive the training. Two curriculums are listed in the brochure, both four-year courses—ceramic engineering and ceramics. Additional copies may be obtained without charge by writing to the Illinois Ceramics Institute, Ceramics Building, Urbana, Ill.

WILL EXPLAIN PRIORITIES

The Office of Production Management has called a meeting of trade association executives at the Mayflower Hotel, Washington, D.C., on Friday, August 1. Its purpose is to acquaint trade associations with the operation of the priorities system. Delegates have been asked to send in advance questions on problems that are proving most troublesome to their industries.

• The O. Hommel Company, Pittsburgh, Pa., announces the addition of Phillips C. Stryker to their sales and service department. Mr. Stryker was formely with the General Electric Company and the Hanovia Chemical and Manufacturing Company.

CONCERN OVER FUEL SUPPLIES

Although by and large the glass industry is relatively immune from the shortages of raw materials and supplies that are plaguing other lines, a few sore spots exist that are beginning to cause concern. One is the problem of fuel. Those dependent upon coal will have to reckon with an anticipated shortage of freight cars during the crop shipping season, which begins in mid August and lasts into October. In many territories, oil is scarce; in fact, the Bridgeton plant of the Owens-Illinois Glass Company already is switching from oil to producer gas.

Factories not already equipped for liquefied gas but which have considered its use are due for a disappointment. Phillips Petroleum Company, one of the important producers have announced a policy of filling no orders except to present users. This action was made necessary by the increased consumption on the part of present customers engaged on defense orders, and also by uncertainties as to future supplies of crude oil in the East which may limit the amount of liquefied petroleum that may be refined there.

• Battelle Memorial Institute has under construction a $160,000 addition to its process metallurgy laboratory building. Institute Director Clyde E. Williams states that current research investigations at Battelle are instituted partly by industries closely associated with the defense program and partly by those industries that are anticipating the adjustments of the post-emergency period with new and improved products and reduced costs.

GLASS BATCH LOADS HANDLED AUTOMATICALLY

• Glass batch loads are automatically handled from the point where gathering is completed to the top of the Tramrail Elevator. Here again synchronized operation of a motor operated pusher removes the batch bucket from the elevator. After removal from the elevator it becomes part of a Tramrail Tractor load to the dog house.

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OVERHEAD MATERIALS HANDLING EQUIPMENT
Other products: CLEVELAND CRANES and STEELWELD MACHINERY

Cleveland Tramrail is the World's Largest Builder of Tramrail Overhead Materials Handling Equipment

SHORT OF CULLET? TRY BOMBING

The collection and disposal of broken glass resulting from air raids has become quite a problem in England. After each bombing, quantities of broken and splintered glass clutter the streets. What happens to it? A good deal is reused as cullet.

As soon as the all clear signal has sounded, an organization set up by local authorities goes through the streets and collects the fragments of glass. The collectors sort and separate the different kinds and colors and ship it out of the bombed area to storage depots.

A good deal of the broken glass is unfit for use. Some of the glass has become mixed with rubble and dirt to such an extent that the cost of separation would be economically unwise. In other cases, it is covered with blackout paint. Nonetheless, up to the end of February, 11,000 tons of good cullet had been salvaged.

ELASTI-GLASS HEARINGS POSTPONED

Final hearings in the Elasti-Glass case, scheduled for July, have been postponed until September, the exact date and place to be announced later. It is understood that the postponement was granted at the request of the respondents, S. Buchsbaum & Co., Chicago. When hearings are resumed they will be held in immediate sequence in Washington and Chicago, following which the matter can be presented to the Federal Trade Commission for disposition.

S. Buchsbaum & Co. are manufacturers of a plastic material which they have named Elasti-Glass. Articles of clothing, such as belts, suspenders, etc., made from Elasti-Glass, have been sold and represented as made of glass. The manufacturers claim Elasti-Glass *is* glass—organic glass, a contention which the Federal Trade Commission denies. It is seeking to prevent the respondents from selling its merchandise as glass on the grounds of unfair competition. Full details of the case to date appeared in THE GLASS INDUSTRY for July.

GLASS ELECTRODE AND CHEMICAL DURABILITY

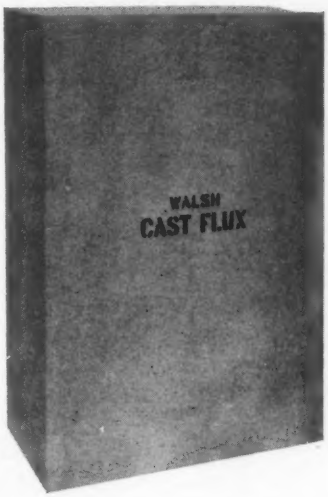
Studies made by Edgar H. Hamilton and Donald Hubbard to ascertain to what extent the chemical durability of the electrode glass is associated with voltage departures, voltage irreversibility, and potential drift of the electrode in alkaline solutions, are reported in the July *Journal of Research,* National Bureau of Standards.

The attack-voltage departure relation appears to be a straight line, while the voltage irreversibility and potential drifts are qualitatively consistent with a durability interpretation. It is known that glass surfaces after suitable treatment have the capacity to absorb certain dyes such as Victoria Blue B. By applying this property, it has been shown that the inner and outer surfaces of electrode bulbs are very different and hence asymmetry potential may be correlated with the relative chemical durabilities of these two surfaces.

L-O-F EARNINGS

Libbey-Owens-Ford Glass Company has reported net earnings for the six months ending June 30 to be $5,377,246.77, or $2.14 a share. This compares with earnings for the corresponding period in 1940 of $5,176,748.09, or $2.06 per share.

WALSH CAST-FLUX



The Vacuum-cast flux block of superior quality.

Walsh Cast-Flux blocks are machine-trued to exact size and shape after burning.

THEY LAST LONGER

The excellent results obtained in numerous tanks melting various types of glass has definitely established the efficiency and economy of Walsh Cast-Flux blocks.

Walsh Cast-Flux has a dense, uniform structure; it is burned at higher temperatures, is thoroughly bonded and possesses a low coefficient of expansion.

Walsh Cast-Flux blocks meet the most rigid requirements for tanks operating at higher temperatures . . . they insure greater tonnage, higher quality glass, freedom from defects, longer life and maximum economy.

WALSH REFRACTORIES CORPORATION

Manufacturers of Refractories for the glass industry for over 50 years

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American Felt Company

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Plants at Glenville, Conn., Newburgh, N. Y., Franklin, Mass., City Mills, Mass., Detroit, Mich.

Manufacturers of **Polishing Felt, Scratch Wheel Felt, Polishing Wheels, Glass Setting Strips, Blocking Felt, Channel Felt, Table Cover Felt.**

4 Glasshouse Castings

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- GUNITE A-CA
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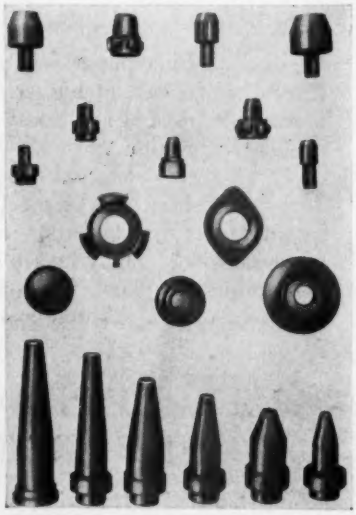

GUNITE FOUNDRIES CORPORATION

ROCKFORD ILLINOIS

Established 1854

NAVY "E" AWARDED B&L

Seven thousand employees of the Bausch & Lomb Optical Company, Rochester, N. Y., which produces most of the "eyes" for national defense, won the unprecedented right to wear the Navy's coveted "E" on July 19. "E" is the navy insignia denoting "well done." Also, the plant became one of the first 14 in the country entitled to hoist the blue, red and yellow flag of the Naval Ordnance Bureau.

In ceremonials at his office in the Navy Building, Washington, Navy Secretary Frank Knox cited the Rochester defense production workers and their employers as tops in their field; men who, called upon "for miracles of industrial production," have provided those "miracles of production." Mr. M. H. Eisenhart, president of Bausch & Lomb, received the award from the Secretary of the Navy; accepting it as an honor, not for the management but for the patriotic loyalty of the B&L employees who have "made this possible."

TYLER GLASS SUSPENDS OPERATIONS

After six weeks of operation, the Tyler Glass Company, Paden City, West Virginia, suspended operations July 1. Failure of the enterprise was due to no lack of business, according to the management, but to the fact that the demand today is largely for light weight containers and the operating equipment was not sufficienty modernized to manufacture this type of ware. For example, the company's tanks were basically the original structures found when the present owners took control, but rebuilt. Forming equipment consisted of Knox-O'Neill Vacuums and O'Neill machines. The plant has been put on the market.

U.S. MAY DEMAND PACKAGING IN GLASS

Glass container production is expected to receive another upward boost at the expense of the tin can manufacturer. For months it has been known that should any serious disturbance take place in the East Indies, a shortage of tin plate was inevitable. When the lid finally did blow off in late July, tin plate manufacturers received a hurry call to OPACS (July 25th) to discuss ways and means. No specific proposals have emerged so far, but the edict should go forth from Washington almost any day requiring can users to find a substitute package for many products they now pack in tin.

Beer cans will be among the first to feel the axe. It will be a matter perhaps only of days—not weeks—before the beer can will be taboo and it will be possible to pack beer only in glass. As a corollary to this, all glass containers are facing limitations on their size and shape to certain standard items. This will save mold metal, and it will also increase the productive capacity of glass factories and enable them to take care of the new volume accruing to them from many former tin can users.

U.S. IMPORTING ENGLISH STAINED GLASS

British manufacturers of stained glass are reported to be making heavy shipments of stained glass windows to the United States. One company has just sent to this country the fifth of a series of six windows, each 40 x 12 feet, which with a west window, 45 x 18 feet, will be placed in the Church of the Heavenly Rest in New York City. This same concern states that it has large contracts with other churches in the United States.

PERSONAL MENTION

F. C. BALL HONORED

Frank Clayton Ball, president of Ball Brothers Company of Muncie, Indiana, was awarded the degree of doctor of science in absentia at the commencement exercises of Keuka College on Tuesday, June 3. Mr. Ball is a member of the college Board of Trustees. His uncle, Dr. George H. Ball, was the first president of Keuka College, in whose memory Ball Memorial Hall is named.

• Lawrence E. Barringer, engineer of insulations, General Electric Company, was awarded the honorary degree of doctor of science at the commencement exercises of Alfred University's New York State College of Ceramics in June.

• H. A. Van Derck Frechette, who has held a Graduate School scholarship in Ceramic Engineering during the past year, has received an appointment as Teaching Assistant at New York State College of Ceramics at Alfred, New York, for the coming year. He received his M.S. from Illinois last June after spending two years as Research Graduate Assistant in the Engineering Experiment Station.

• A. R. Rodriguez from Manila, Philippine Islands, received his Ph.D. degree in ceramics from the University of Illinois. After spending several months visiting manufacturing plants in this country he is going back to Manila about September to start a Department of Ceramics at the University of the Philippines.

• J. A. Pask, who has been an instructor in the Department of Ceramic Eng., has received an appointment as Acting Assistant Professor of Ceramics at the University of Washington in Seattle. He will start his new duties in September.

Pask graduated from Illinois in 1934 and then spent a year at the University of Washington where he had a fellowship in ceramics from the college and U. S. Bureau of Mines. After that he worked as ceramic engineer for the Willamina Clay Products Co. in Willamina, Oregon, before coming back to Illinois on an Engineering Experiment Station Fellowship, which was followed by an assistantship, and lastly an instructorship.

• Mr. Ernest M. Hommel has been elected president of the O. Hommel Company, Pittsburgh, Pa., filling the vacancy caused by the recent death of his father, Oscar Hommel. Mr. Hommel for the past 18 years has been sales representative and since 1929 a vice president of the company.

• Frank L. Dimmock, partner in Friedrich & Dimmock, died May 28 at St. Vincent's Hospital, New York, at the age of 62. He had been a partner in the company since 1919. Before joining Friedrich & Dimmock he was with the International Glass Company.

GLASS DIVISION SUMMER MEETING

The summer meeting of the Glass Division of the American Ceramic Society will be held at the Hotel Conneaut, Conneaut Lake Park, Pa., on September 12 and 13. Chairman A. K. Lyle states that the program is still in the formative stage, but it is expected that it will be completed in time for announcement in the September GLASS INDUSTRY.

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This new material for incorporating ALUMINA in glass at lower cost is providing excellent results.

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SHOREHAM BUILDING
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Pioneer Producer of APLITE
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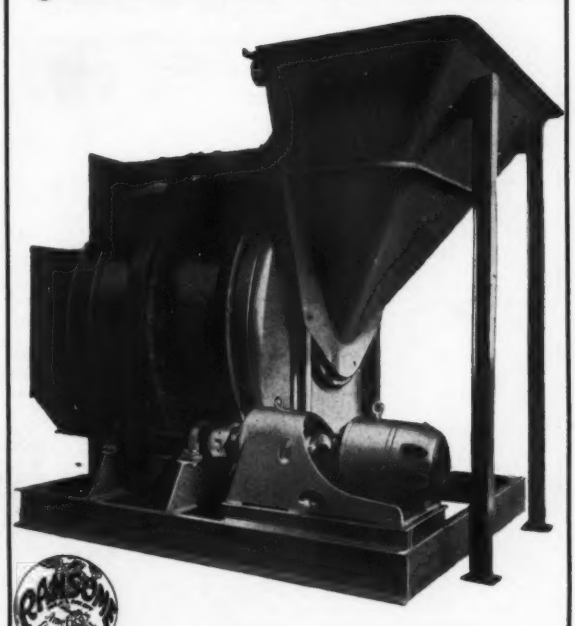

Industrial Division
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FLUXTITE by LACLEDE-CHRISTY

. . . the tank block of accurate structure balance made by ceramic experts from a precision blend of fire clays, including the famous Missouri Washed Pot Clays.

Fluxtite and its companion products, Laclede's Super Refractory Mix 89 and Laclede's Refractory Upperstructure, have been and are now meeting the strict requirements of the producers of soda-lime, boro-silicate and all other glasses.

Laclede-Christy, "The Glass Industry Specialists," have everything in refractories for the glasshouse. Consult with . . .

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COLORS that *Sell!*

● Colors from HOMMEL give extra attractiveness to your products—lend an unusual richness that SELLS. Hundreds of satisfied customers use eye appealing HOMMEL shades for finest results.

Transparent and Opaque — Enamels and Fluxes — Liquid Lustre Colors — Acid and Alkali Resistant — Ices — Squeegee Colors — Burnish Gold and Silver.

Complete line of Glassmakers Chemicals including Barium Carbonate — Borax—Cadmium Sulphide—Feldspar — Fluorspar — Manganese Dioxide — Potassum Bichromate — Soda Ash — Sodium Nitrate — Uranium Oxide.

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The PRINCE of GLASS SANDS

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THREE PLANTS TO SERVE YOU

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for

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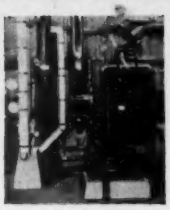
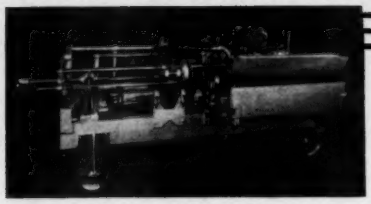
Complete Glass Manufacturing Plants

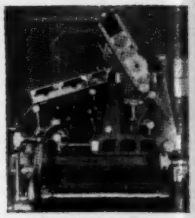
AMCO EQUIPMENT *for the glass industry*



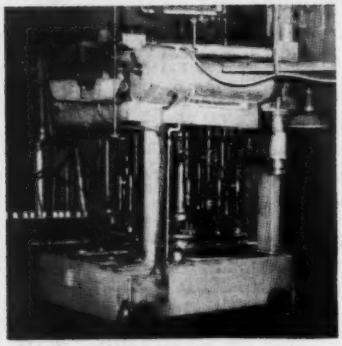
Fuel Oil Systems



Tube Drawing Machines



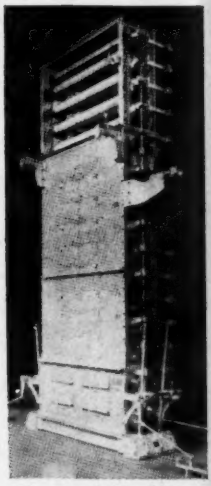
Rolled Sheet Glass Machines



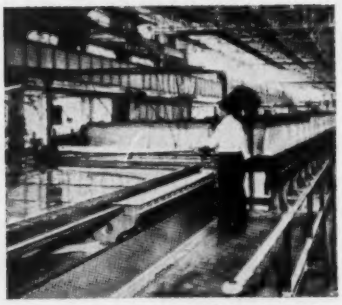
High Speed Presses

Grinding and Polishing Equipment

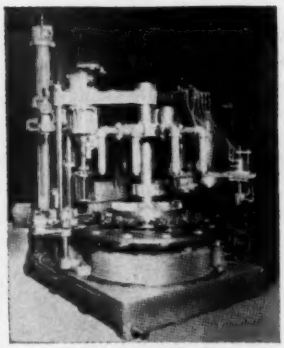
Marble Machines



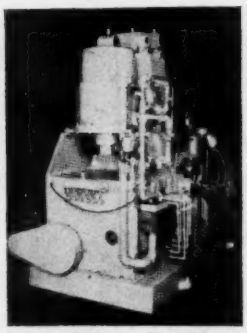
Fourcault Machines



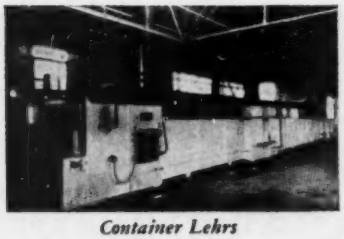
Sheet Glass Lehrs



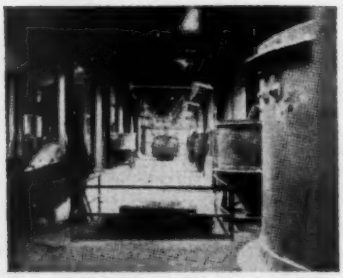
Heavy Duty Presses



High Speed Tumbler Presses



Container Lehrs



Batch Mixing and Storage

Glass Melting Furnaces

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